modern machine shop

DECEMBER 1961

A LOOK AT E. D. MACHINING See Page 82

HOW TO PROGRAM CONTINUOUS PATH N/C MACHINES See Page 92

The MAGAZINE for PRODUCTION EXECUTIVES in METALWORKING PLANTS



HARDINGE ELMIRA, N.Y. Machining Beryllium at Pioneer Astro Metallics Corp., Chicago, Ill., for guidance systems, disk and drum type computers, flight control systems, and atomic energy projects. HARDINGE machines are used exclusively to maintain super-precision tolerances.



REJUVENATING RED-HEADS

How to make an old Boringhead or Wheelhead Good as New

by Arthur Walsh
Manager, Parts Sales
The Heald Machine Company

There's only *one* way to make an old Red-Head good as new. Return it to its maker!

This statement is neither facetious nor exaggerated. Let's look at the facts.

A precision machine tool spindle, although basically simple in design, is one of the most carefully engineered and meticulously manufactured components of the entire machine. This is particularly true of Heald Red-Head Boringheads and Wheelheads. It has to be that way, for on the *spindle* depends the performance of the machine and the reputation of the Company.

When a Red-Head Wheelhead or Boringhead needs reconditioning, and you want it restored to original Red-Head precision, ship it back to us here in Worcester. For nobody knows as much about a product as the company which made it. And certainly no one else has so much

at stake on its performance!

When a head comes back here we give it the full Red-Head treatment. This includes as *much* or as *little* as needs to be come to make it as good as new. Any or all of the following items may be replaced or reworked, depending on their condition—body, spindle, caps, slingers, pulleys, spacers, spring cages, bearings and miscellaneous parts. Only the finest Ultra-precision bearings made to Heald specifications are used—precision matched for exactly the right internal clearances, fits and preloads.

After final inspection and reassembly, every rebuilt Red-Head is run continuously on the test jack for eight hours to check for temperature rise, noise level and vibration. A head that passes all of our inspections and tests is in every respect as good as new.

The cost depends on the amount of work done and the parts reworked or replaced. But in all cases you get a head that carries the original Heald guarantee, at far less than the cost of a new head.



Anti-Friction bearings for Heald Red-Heads are carefully selected and thoroughly inspected before assembly into any Red-Head—the same rigid specifications must be met for bearings to be used in either new or rebuilt heads.

It PAYS to come to Heald

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WORCESTER 6, MASSACHUSETTS

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modern machine shop

For Production Executives

Vol. 34, No. 7, December, 1961

contents

Electrical Discharge Machining	A Look at Electrical Discharge Machining
Die Design	Zee Clip Producing Die90 By Roger Isetts
Numerical Control	Let's Discuss Numerical Control92 By K. M. Gettelman
Thread Cutting	Cutting 0 to 45-Degree Buttress Threads
Drilling	Low Cost Numerically Controlled Drill Hits Market 110
Boring	Cartridge Boring Provides "Recoverable Tooling"118
Heat Treating	Nitriding Furnace Increases Quality Control120
Tapping	Machining Truck Shackle Pins122
Welding	Low Cost Welding of Blast Furnace Boxes124
Carbide Tooling	Stub Boring With Titanium Carbide Tools126
Tool Design	Rigid Bull Center
Fastening	Anchoring T-Slot Bolts
Chucking	Springs and Metal Tubing Make Chuck Jaw Spacers 132 By H. J. Gerber
Article Index	Modern Machine Shop 1961 Article Index 133

departments

Important Meeting Dates 64	Ideas from Readers	NED
Advertising Representatives 69	Free Literature	
Over the Editor's Desk70	News of the Industry156	MEMBER (EZ)
Report from Washington74	New Equipment	
Modern Machine Shop-Talk78	Where to Get It	
More Production118	Advertisers In This Issue262	BPA

A STATEMENT OF POLICY—The principal function of MODERN MACHINE SHOP is to search out and disseminate the best and newest ideas for advancement of engineering skill and mechanical efficiency in the metalworking industry and neither effort nor expense is spared in the performance of this task.

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page

82 A LOOK AT ELECTRICAL DISCHARGE MACHINING

By Gilbert C. Close

What is electrical discharge machining? How do these machines operate? What sort of tooling do they employ, and why? What are their major fields of advantage, and wherein are they specifically advantageous? Can a logical comparison be drawn between electrical discharge machining and the more conventional metal removal techniques? To obtain dependable answers to these questions, The L. C. Miller Company, Monterey Park,



California, was approached. L. C. Miller has been specializing in electrical discharge machining since the first machines became available. As a job shop doing all sorts of work on all sorts of materials, they have had ample opportunity to explore all magnifications of electrical discharge machining.

90 ZEE CLIP PRODUCING DIE

By Roger Isetts

This article describes and illustrates a die which is designed to make a zee clip from 0.050-inch strip aluminum by combining piercing, cut-off and forming operations in one unit. Each press stroke produces a finished piece with no scrap loss.

92 LET'S DISCUSS NUMERICAL CONTROL

By K. M. Gettelman

One of the important considerations in the operation of numerically controlled machine tools is programming. Although the formalization of a program on perforated tape, magnetic tape, or tabulating cards is relatively new, the concept is as old as manufacturing itself. This article, fourth in the numerical control series, thoroughly investigates the creation of programs for continuous path type numerically controlled machine tools.

in this issue

page

102 CUTTING 0 TO 45-DEGREE BUTTRESS THREADS

By D. E. Youtz

The buttress thread dates back as early as 1888 when a description appeared in the Journal of the Franklin Institute. This form with its saw tooth profile is for uni-directional forces, disposing them in such a way that the radial component is as small as possible. For this reason it is considered excellent for tubular products, when greater than average forces will be encountered and the need for reduced bursting tendencies caused by conventional flank angles must be met at threaded connections. The use of buttress threads has not been limited to tubular products, however, but has found application on such items as jackscrews, ordnance, and so on.

110 LOW COST NUMERICALLY CONTROLLED DRILL HITS MARKET

Taking the plunge to prove that numerically controlled machine tools are here to stay and that they offer unique and tangible savings in money, time, setups, and other areas which can be directly translated into a monetary figure, Pratt & Whitney Co., West Hartford, Conn., recently unveiled an N/C drill called the Tape-O-Matic. According to the company, Tape-O-Matic achieves a breakthrough not only in electronic reliability of the control system but more importantly

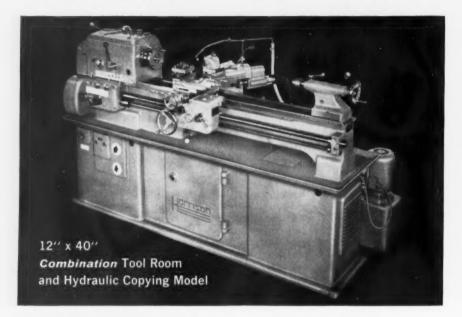


control system but more importantly a breakthrough into a selling price "far below anything ever dreamed of previously."

133 MODERN MACHINE SHOP 1961 ARTICLE INDEX

This index provides a convenient subject listing of articles published in *Modern Machine Shop* during the past year. It is our suggestion that the readers of this magazine save this helpful article index for future reference purposes.

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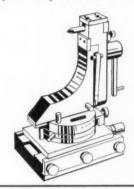
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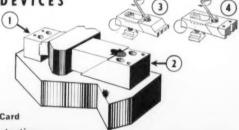


6. DOWN-HOLDING DEVICES

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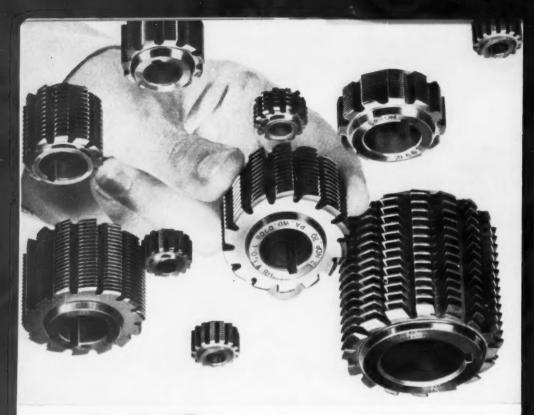
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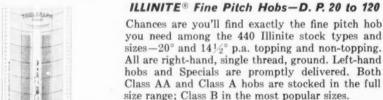
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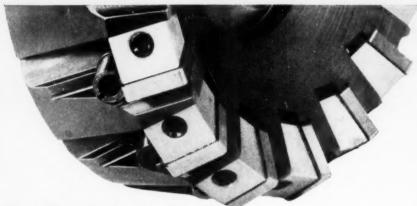
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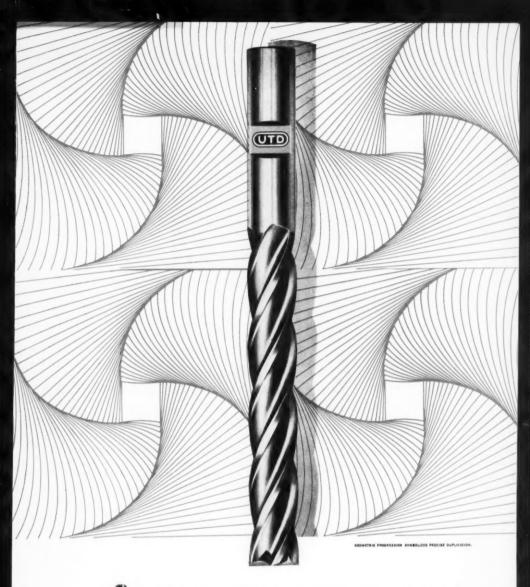
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7



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NOTICE to owners of thousands of Cincinnati Centerless Grinding Machines built between 1935 and 1945:

Almost everything about your old CINCINNATI Centerless Grinder is obsolete! It may be just as good as the day you bought it, but that's no longer good enough!

Your machine is obsolete because our new Centuramic makes available substantial increases in quality, accuracy and dependability—and important reductions in your costs. Here are the features that make the new Centuramic such an efficient producer:

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AUTOMATIC GRINDING WHEEL BALANC-ING. Without this feature you are probably spending more than one hour balancing the wheel. It takes only a few seconds with automatic balancing. You get better accuracy, longer wheel and diamond life and shorter grinding cycles.

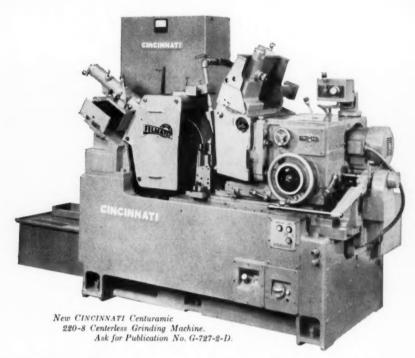
ELECTRO-HYDRAULIC INFEED. Feed rate and sparkout time are precisely the same for each part.

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trols are centralized (convenient rear handwheel available) to permit operators to produce more with less effort.

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MANY MORE COST-REDUCING FEATURES. Up to 20" wide grinding wheel—fewer passes, more economy. Hydraulic grinding wheel reciprocation for better finish on infeed jobs. Ball slides for high precision adjustment, minimum wear. Differential handwheel adjustment to .000050". In-

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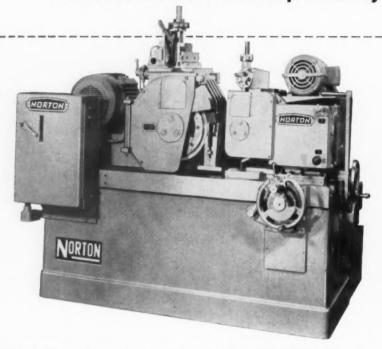
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SOLID SUPPORT for the "Touch of Gold"

The Norton No. 2 Straddle-Bearing



Centerless Grinder is built for productivity...

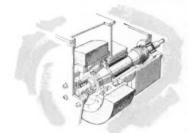


The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semiautomatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 434" depending on type of work rest and bar grinding flature.

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3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING

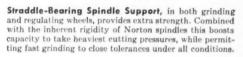


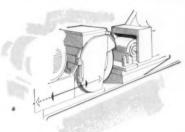
accuracy...economy

Like all Norton grinders and lappers the Norton No. 2 Straddle-Bearing Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

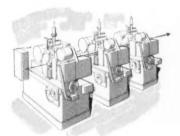
You'll find plenty of proof of that in the modern construction of this newest machine of its type. Straddle support of spindle bearings adds strength and ability to take tough jobs... the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

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Robbins Angular Tooling Saves Time...

IN GRINDING Single or compound angles set up in seconds with this Robbins Magna-Sine. Available in a range of sizes, Magna-Sines double as "everyday" magnetic chucks for all surface grinding jobs, or can be used off the machines for bench work.

IN MACHINING Heavy-duty 12" x 12" or 24" x 24" Sine Plates permit safe, accurate angular machining without V-blocks or angle plates. Non-magnetic top plate has tapped holes and T-slots. Special construction resists stress of boring and milling.

IN INSPECTION Four quick steps to easy setups: 1. Check Table of Constants for standard gage block needed for proper angle. 2. Select gage block. 3. Insert gage block and lock top plate. 4. Position work. Versatile 4" x 4" model shown here is also available as magnetic Magna-Sine.

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A1.18

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Add a single- or multiple-pass JETracer to reduce tool costs, setup and inspection time, and increase versatility.

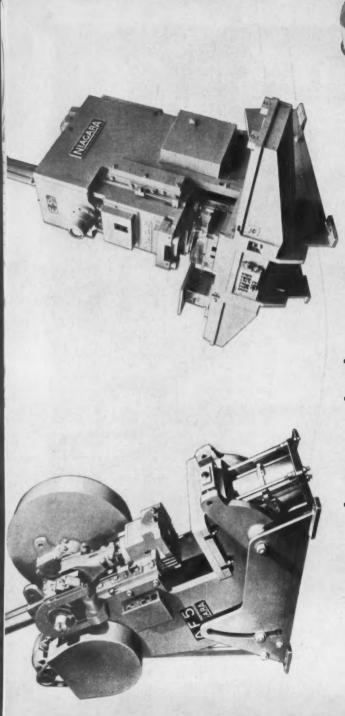
If your "lost order reviews" dictate more automatic machining operations . . . you'll be surprised and relieved to see how easy it is to cut costs with a Gisholt No. 12 Automatic Production Lathe. New, faster setup methods assure maximum profit on short runs and the speed, capacity and horsepower have been increased to give you maximum production with carbides.

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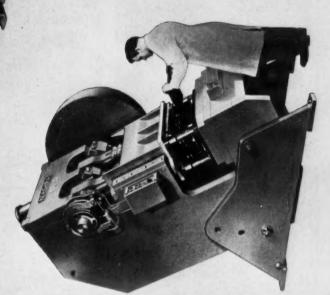


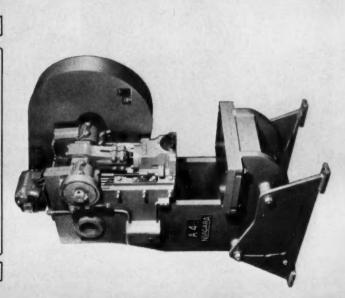
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Marvel No. 8 Universal Metal Cutting Band Saw Capacity: 18" x 18"

MARVEL Metal Cutting SAWS

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BETTER BLADES

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The most popular surface grinder for tool and die work. Hand operated with a $12^{\prime\prime\prime}$ wheel for deep slot grinding, 1 hp motor and $10^{\prime\prime\prime}$ x $15^{\prime\prime\prime}$ worktable capacity. Shown with wet grinding attachment.



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No. 6

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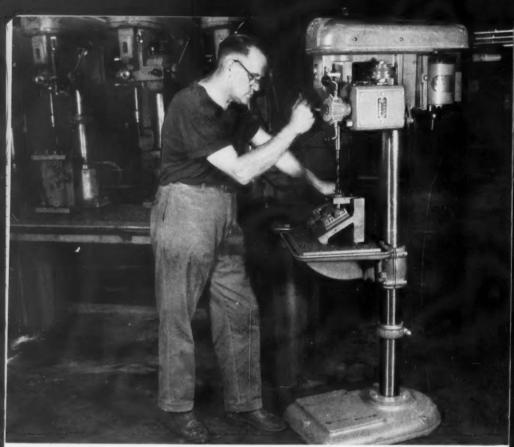


18" FACE GRINDER

New hydraulic $18^{\prime\prime}$ face grinder for grinding workpieces requiring flat surfaces. Has $12^{\prime\prime}$ x $36^{\prime\prime}$ worktable capacity, $18^{\prime\prime}$ wheel and 15 hp motor. Also available as hand operated machine.

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LANDIS TOOL COMPANY, WAYNESBORO, PA.



ALL NEW Capacity—Equipped with exclusive Rockwell Power Feed these drill presses handle many production jobs ordinarily done by costly, fixed equipment.

In addition, they offer portability that can be utilized to perform extra drilling jobs on limited runs or relieve production line bottlenecks.

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—Tilts up and back out of the way giving operator plenty of room to make belt and speed changes quickly, easily. Three specially designed supports and a stop hold steel guard in "up" position, built-in clips automatically lock guard in operating position when closed.



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ALL NEW DELTA 17" DRILL PRESSES

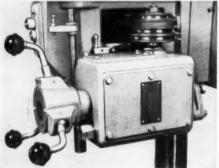
Here is a major engineering advance from Delta to give you more drilling accuracy, job flexibility and operating economy. You can choose the machine best suited to your needs from 76 models in a complete line of 17" drill presses that incorporate the most up-to-date performance features.

These drill presses are completely new -not merely improved or re-styled-but actually re-designed to deliver consistent precision operation under the most rugged work loads with little or no maintenance.

Your Delta Industrial Distributor (listed under "TOOLS" or "MACHIN-ERY" in the Yellow Pages) will gladly demonstrate how these 17's can save you dollars, hours and material. Why not call or see him soon!



FREE BROCHURE—Complete specifications and details on the full line of all new 17" drill presses and accessories. Simply write: Rockwell Manufacturing Co., Delta Power Tool Division, 606M N. Lexington Ave., Pittsburgh 8, Pa.



ALL NEW Rockwell Power Feed - Available as original equipment or as an accessory on every model, this advanced development gives you: a front mounted pilot wheel for one hand operation and "flick of the wrist" control of feeding; infinitely adjustable drill point pressure and a built-in feature that permits remote control. For semi or fully automated operations, power feed can be electrically, hydraulically, pneumatically or mechanically interlocked with other machines.



CHOOSE FROM 76 MODELS

Selection includes: floor, bench or multiple spindle machines equipped with standard or production table, standard or Rockwell Power Feed, key chuck or tapered spindle, high or slow speed.

DELTA INDUSTRIAL TOOLS

another fine product by



For more data circle 327 on Postpaid Card



for fast, economical = production ~ of shapes like these ...

Lockformer's "Custom Shape" Roll Forming Machines equip your shop for production of special shapes at speeds unmatched by any other forming method! It takes only a single pass to turn out even complex contours-

one operation by one semi-skilled operator, with production rates up to 100 fpm.

Single and Duplex Head Models are available with roll sets made to your exact specifications.

Write today for a complete set of Data Sheets showing how your shop can make special shapes at less cost with a Lockformer.

FREE DATA SHEETS

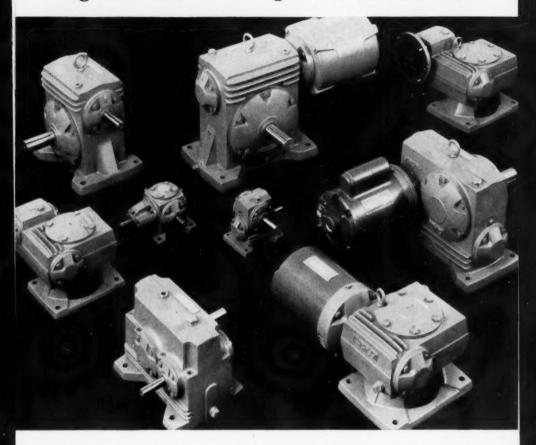
Yours for the asking . . . a complete set of Lockformer Data Sheets giving complete job details on a wide variety of parts. THE LOCKFORMER COM-PANY, Dept. MS, 4615 W. Roosevelt Rd., Chicago 10, Illinois.



In Canada: Brown Boggs Foundry & Machine Co., Ltd., Hamilton, Ontario

BOSTON QUALITY

time-proved REDUCTOR* and RATIOMOTOR* reliability largest selection for worm-geared drives from stock



Horizontal or vertical, right angle or parallel, single or double reduction.

Reductors - for .10 to 15 HP drives - ratios 1:1 to 3600:1.

Ratiomotors - .035 to 10 HP - output torque 4 to 9400 in. lbs.

Detachable motor design. Motor can be changed in minutes.

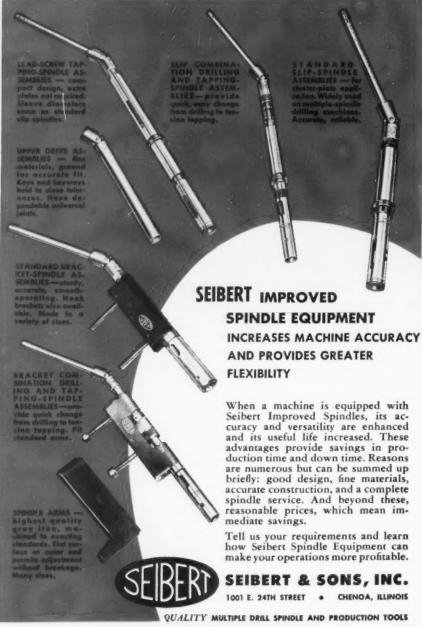
Ratiomotors sold also without motors as Flanged Reductors.

1605 stock sizes, types, ratios. See Catalog 57 for complete listings.

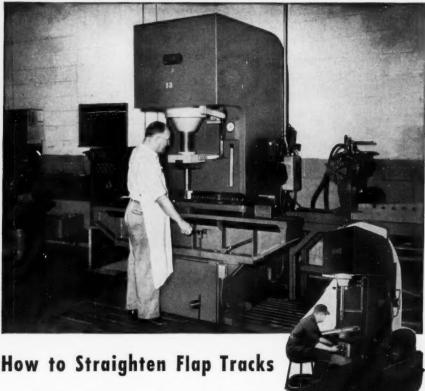
IN STOCK at your nearby DISTRIBUTOR



© Boston Gear Works, 1961 Quincy 71, Mass.



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How to Straighten Flap Tracks

Precision parts for aircraft call for the use of precision equipment.

These flap tracks, machined from 4130 steel (aircraft quality), must be checked on a straightening press four times during fabrication. For ease of control and accuracy, the work is done on Dake Gap Type

Presses like that shown in the photograph above.

To the right of the ram, the operator has placed a rule gauge which indicates ram travel. Knowing the elasticity of the piece being tested, he can estimate the overtravel necessary to straighten the piece with a single movement of the ram.

Dake Gap Type Press broaches boring bars

Dake Gap Type Presses are available for straightening or forcing, in 22 models ranging up to 300 tons capacity. They are fully described in Bulletin No. 299-sent on request.

DAKE CORPORATION 612 Robbins Road, Grand Haven, Mich.

PRESSES















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Here are the finest American made micrometers on the market—overall accuracy within .000050—and as much as \$3 less than other makes.

The tool steel ground and lapped thread is hardened throughout to 64 Rockwell C to insure longer life and greater accuracy. A hand adjustable take-up nut engages 11 to 13 threads thereby practically eliminating the need for wear adjustment. Thimble lines are elongated

and accurately graduated so that line width is held within .006" to .007" for accurate reading. Every ST mike has a serially numbered certification of accuracy.



1"5 MICROMETERS



Drop forged solid steel frame—½" anvil length—Lustro-Chromed head—has locknut, ratchet and 1/10,000° vernier—0" to 6" models available.



Light-weight, vacuum sealed tubular frame minimizes hand heat distortion—black wrinkle finish—has locknut and ratchet—reads to 1/1,000°—0° to 96° available. 1/10,000° vernier available.



Rib-reinforced drop forged solid steel frame—anvil will enter ¹³/₆" slot—has locknut, ratchet and 1/10,000" vernier—
0" to 6" models available.



Reads to .0001"—full finished solid frame—Lustro-Chromed frame and head—has locknut, ratchet and 1/10,000" vernier—2" model also available.

Write to us for new S-T Catalog 25 "Precision Measuring Tools and Instruments" and the name of your nearest stocking dealer.



322 Armstrong Ave., St. James, Minn. BRANCH OFFICES: New York 12, N.Y., Chicago 44, III., Los Angeles 19, Cal.

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Tool Co.'s shop, Orange, Conn.

"M14 Springfield Rifle" (Official gun for "Nato")

"THE MOST for the LEAST"

Regardless of the size of your shop, be it large or small, why not get all the facts concerning the "Bridgeport" and the many reasons why it is such a popu-lar and profitable tool in the metal working market. Contact your nearest dealer or us direct for details. The modern, highly efficient plant of the Mathewson Tool Company, Orange, Connecticut is literally built around Bridgeport Millers.

The very first "M14 Springfield Rifle" (official gun for "Nato") was prototyped on Bridgeport Machines and according to Mr. Mathewson, President, "Our present 16 Bridgeports, with their precision, versatility and reasonable price helped us tremendously to build a modern and profitable business."

The experience at Mathewsen Tool Company while most interesting, is by no means exclusive with this shop. It is, however, an outstanding example of what is being accomplished in metal working by Bridgeports and again points the way to lower costs and better profits through modernizing the "Bridgeport Way."

Bridgebort MACHINES, INC.

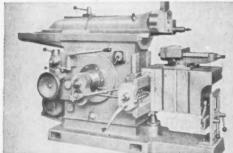
Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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NEW 1962

EXTRAORDINARY PRECISION & QUALITY INCOMPARABLE BEST VALUES IN U.S.A.



EXCELSIOR Single Pulley SHAPER Model 625 FORCED FEED LUBRICATION SWIVELING TABLE

Stroke of ram	1911/6"
Cross adjustment of table	25%
Vertical adjustment of table	
Surface of table19"	x 141/4"
Number of strokes per minute 20-45	-85-110
Motor power	



AARON MACHINERY CO., Inc

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BRANCHES AT: MINEOLA, N. Y. OAKLAND, CAL. LOS ANGELES, CAL. HOUSTON, TEXAS

10 Models from \$3162.

DeVlieg

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AVAILABLE WITH
DUPLITROL®
PROGRAMMING
DIATROL®
DIRECT DIAL DIMENSIONING OR
TAPAC*
TAPE CONTROL

*Trademark - De Vlieg Machine Company

micropoint®

The first grinder in its field able to grind tool profiles geometrically correct to gage room accuracy.

microbore®

The complete tooling system with over 300 Standard Single Point Tool Applications from stock including Carbide, Ceramic and High-speed Steel Tips • Special Cluster Tooling • Flash-Change Tooling • Microface Adjustable Blade Facing Heads • Microbore Tooling with Kendex "throw-away" Inserts • Ceramic Tipped Cutting Tools.

DEVLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN
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3H-46 DEVLIE

JIGMI

How to save money and make money with modern metallizing

With today's improved metallizing materials and methods:

PLANT EXECUTIVES find new ways to slash maintenance costs, reduce downtime, cut machine parts inventory...

JOB SHOP OPERATORS find new ways to build highly profitable business doing parts-salvage and maintenance work for plants in their area.

JOB SHOPS make good money with metallizing because they save

good money for local firms.

Metro has prepared a special bulletin detailing actual operations and costs of typical flame spraying work on shafts, templates, bearings, many other surfaces. Use coupon to get your free copy.

NEW! Business-building kit for job shops, to help Metro equipment owners build new business, pay off investment in minimum time, and use flame spraying to increase other machining and welding business. Contains samples of direct mail letters, post cards, envelope stuffers, photos, advertising mats. These promotion materials are available in lots of 100 at our cost, well below what you'd have to pay to print your own. One copy of kit available free—send for it today. (See coupon.)

These real-life examples show how plants save money, job shops make money with metallizing

Necks of winding rolls in a textile mill were formerly repaired by a slow machining method, requiring highly skilled labor. Now the worn necks are built up with flame sprayed metal, quickly machined to size. Savings run \$20,000 a year.

A job shop in California specializes in flame spraying oil well pump plungers, gets all the business it can handle in spite of the fact that the plungers it hard-faces last eight times as long as new ones. The largest ones cost only \$45.00 to rebuild, against \$110 to replace. Volume on just this one profitable metallizing service: \$35,000 a year.

Valve plugs and seats, working in sand, oil and salt water, lasted only a few hours in service. Hard-faced by welding, a set cost \$155, lasted from 3 to 8 hours. When flame sprayed with tungsten carbide powder, service life was increased to a minimum of 2 weeks, 4100% longer! Cost of metallized set, \$73. But reduced downtime far outweighs the dollar sayings.

A Connecticut job shop makes a very good profit when it flame sprays small







Any good mechanic can quickly master the three basic steps of metallizing: 1. prepare the surface; 2. flame spray; 3. finish.

shafts for \$27.50. The customer is happy, too—he formerly had to pay over \$50 to have shafts built up with welding.

The same job shop salvaged a big degreasing tank, value \$2,850, by flame spraying with zinc for \$683. The shop made money, the customer saved money.

A shipbuilding company installed metallizing equipment to repair such parts as pump rods, pistons, crank shafts for diesel engines, stern bushings, valve stems. A badly worn tugboat shaft, replacement cost \$3,000, was repaired and made better than new for \$400. That job alone more than paid for the Metco equipment.

From these cases you can see how modern metallizing pays, whether in plant maintenance departments or in job shops serving the many companies that don't need their own installation. Wherever there's wear, in rotary or sliding action, there's an opportunity to save money and make money.

New and improved materials

Among these new materials are a number of nickel, chrome, boron hard facing powders. Sprayed tungsten carbides are also widely used. Many others are available to give new values to the basic benefits of metallizing, which may be summarized as: less downtime; far less machining or grinding time, reduced parts inventory; and "better than new" performance of the metallized parts.

With savings like these there is plenty of leeway for good job shop profits and big savings for manufacturing plants. To learn more about these opportunities, check the coupon and send it off today.



FORMERLY METALLIZING ENGINEERING CO., INC. Flame Spray Equipment and Supplies 1177 Prospect Avenue, Westbury, L. J., New York Telephone: Edgewood 4-1300 Cable: METCO. In Great Britain: METCO, Ltd., Chobham-near-Woking, England

How to	Send copy of Bulletin 15
SAVE MONEY and cut downtime with Metallizing	"How to Save Money and Cu Downtime with Metallizing" Have Field Engineer Call
Ti	tle
	and cut downtime with Metallizing

TAKE THE GUESSING OUT OF GRINDING

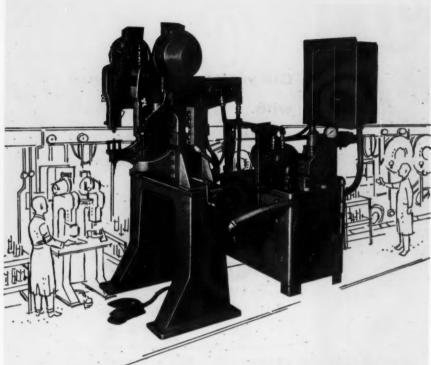
Anyone can now grind a precision cutter



Send for catalog FG-1

new hermes engraving machine corp.,

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A T-U RIVITOR

on your production line means higher production rate . . . lower unit cost!

T-J Rivitors and Clinchors are designed, engineered and manufactured to conform and operate efficiently on today's high-speed production lines. For whatever your product . . . if it demands a fastening assembly procedure . . . a T-J riveting or clinching machine adds to its high quality standards by their ability

in providing long, rugged service-free life.

Many standard designs to choose from . . . or a T-J can be custom designed for your exact requirements. Write Tomkins-Johnson, 2425 W. Michigan Ave., Jackson, Mich., today. Ask for Rivitor and Clinchor Bulletin No. 646 or Clinchor Bulletin No. 555.











KINS-JOHNSO

CYLINDERS

CHTTING TOOLS

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MODERN MACHINE SHOP

.



Cut your costs with QUALITY TOOLS



CLEVELAND Quality Tools are designed and manufactured to

- Cut faste:
- · Produce more parts per grind
- · Reduce costly down-time

Moreover, CLEVELAND Quality Tools give you the added benefits of "Teamwork Tooling", whereby the talents of many people are combined to assist in reducing your costs. "Teamwork Tooling" includes not only our engineering skills and modern manufacturing facilities, but also the capable services of our Suppliers, Stockrooms, Service Representatives and Distributors.

THE CLEVELAND TWIST DRILL CO. Cleveland 1, Ohio



CHITING TOOLS . BEST SERVICE



THROUGH YOUR LOCAL DISTRIBUTOR

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For more data circle 339 on Postpaid Card

Buy tools on PERFORMANCE and SERVICE ... not on price alone



Strictly on their *superior performance*, BAY STATE Taps, Dies and Gages can help you reduce your costs.

Tools bought on price alone cannot be relied upon for dependability and long wear life. Too often they are the cause of costly down-time and excessive scrap.

You get prompt service, too, on BAY STATE Taps, Dies and Gages from your local Industrial Supply Distributor, plus our trained Service Representatives operating out of strategically located Stockrooms to help you solve your thread cutting and gaging problems.

BAY STATE TAP AND DIE CO.

Mansfield, Mass.

Subsidiary of The Cleveland Twist Drill Co.



CUTTING TOOLS



THROUGH YOUR LOCAL DISTRIBUTOR

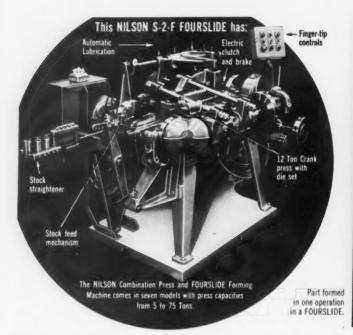
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December, 1961

MODERN MACHINE SHOP

35





Competitive Pressrooms Can Produce and Earn More—with a Nilson FOURSLIDE

The NILSON machine, which combines a crank or toggle press with FOUR-SLIDE forming motions, produces complex stampings in one operation. Standard NILSON FOURSLIDES incorporate built-in stock straightening and feeding mechanisms, together with cam-actuated horizontal and vertical motions, providing many production advantages:

- . Eliminate expensive camming and tooling
- · Reduce material costs-no carrier for metal strip
- · High production rates—up to 200 parts / minute
- · Quick-change cams for fast changeover
- Utilizes lower cost adjustable form tools and dies for multiple sizes
- · Automatic scrap disposal in the horizontal press
- · Additional motions readily available from four camshafts
- · Also handles wire forms requiring press operations
- . Forms wide range of part sizes-up to 4" wide; 16" long
- . Forms on two levels, and minimizes stripping problems



Full explanation of the NILSON FOURSLIDE PROCESS is available in the "FOURSLIDE Design & Tooling Handbook", which is yours for the asking.



THE A. H. NILSON MACHINE CO. • 627 Bridgeport Avenue • Shelton, Conn.

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FANTASTIC!

results and savings...





These 36" x 84" perts were formed minutes apart by simply adjusting hydraulic pressure.

(Photos couriesy of Penton Pub. Co.)

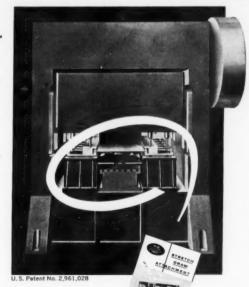
SHAPES...THAT HOLD THEIR SHAPES...

FANTASTIC is often an over used adjective, but definitely not in this case ... Here are the facts, you be the judge!

The new BATH Tension Controlled Blank Holder can save the manufacturer of shallow draw parts over sixty percent in die costs and twenty percent in material costs . . . and the pay-off . . . deliver a better part. Stretching the metal just prior to forming makes the metal

"flowable" or "plastic-like"... result
... no oil canning, no wrinkles. Shallow
draw parts that required a 1,000 ton press
can now be produced on a 100 ton
press. Part spring back is practically
eliminated. If you heat treat, coat
or enamel your parts, they will
still hold their shape... in short,
SHAPES THAT HOLD THEIR SHAPE.

FANTASTIC . . . it could well be just that in your future forming cost picture. Full details are available on this completely NEW process.

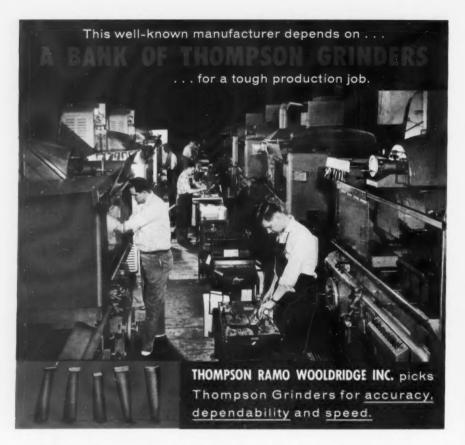




32370 Aurora Road • Cleveland 39, Ohio

(LOCATED IN THE GREATER CLEVELAND AREA) Manufacturers of Radiol Draw Farmers • Dies • Tools Press Brakes • Tangent Bending Sequence Presses • Press Type Brakes • Special Machines WRITE, WIRE OR PHONE FOR LITERATURE.

For more data circle 342 on Postpaid Card



All the Thompson machines shown above in one bank are grinding jet aircraft engine compressor vanes. Each of the 5 surfaces on the root end as well as the concave and convex airfoil surfaces on the lug end are ground to extreme accuracy on the stainless steel forgings.

For the five years that these Thompson machines have been steadily on this job, downtime and maintenance costs have been negligible factors.

Put your toughest production job on a Thompson grinder and watch it cut your costs, speed your production and improve your product.

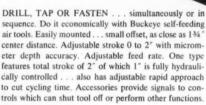


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BUCKEYE SELF-FEEDING AIR DRILLS

LOW-COST HOLES FOR SALE



Drilling Tool Specifications

 Speed Range
 900-22,000 rpm

 Capacity
 ½ε' through ¾ε''

 Weight
 5½ε through 5¾ lbs.

 Length, Overall
 16¹½ε'' through 21½.''



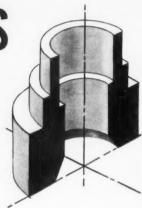
write today for illustrated literature, application studies, templates and prices

BUCKEYE TOOLS

P. O. BOX 966 • DAYTON 1, OHIO Pioneering power tools for industry since 1920

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YOUR ANSWERS TO THIS QUIZ CAN UNCOVER NEW PROFITS



		. Lo	110
1.	Do you grind holes 4" in diameter and larger?		
2.	Do you grind taper holes or mating parts?		
3.	Do you grind on irregular shaped work?		
4.	Do you grind O.D. or I.D. shoulders, offsets, undercuts?		
5.	Do you grind pieces requiring extreme concentricity?		
6.	Do you require a 5 micro-inch or better finish?		
7.	Do some of your grinding jobs require many setups?		П

If you answer yes to three or more questions, a Springfield vertical universal grinder can save time and money in your plant. Write today for your free, informative copy of Bulletin 210-M.

THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO





For more data circle 345 on Postpaid Card



How AUTOMATIC ELECTRIC assembles critical phone parts on DENISON Multipress via high precision...

SPINNING



MIGH PRECISION STIMMING Fedures for final assembly of delicate telephone receiver parts is done within specified folerance of ,001" on this Series "R". Denison Multipress in new Clean Room at Automatic Electric, Northlake, Ill. Write for free Bulletin 324—new "R-S-T". Series Multipress.

FINAL ASSEMBLY of the vital operating components in Automatic Electric's new type 810 telephone receiver calls for an ultra-clean assembly area . . . plus precision presswork to tolerances of .001".

This Denison hydraulic Multipress is one of three Series "R" 8-ton Multipresses installed by Automatic Electric to handle key assembly operations in their new Clean Room.

Equipped with a special spinning die, this Multipress spins the telephone receiver shell-terminal board assembly to a frame-retaining ring assembly . . . joins these fragile parts in an airtight seal against dirt and moisture. Smooth, precisely controlled hydraulic ram pressure—an inherent performance feature of every Multipress—permits a positive, hermetically sealed closure with no damage to the delicate receiver components.

Do you have a pressing problem? Ask your nearby Denison Production Specialist about a Multipress Analysis Program in your plant. He'll help you MAP new ways to cut time and costs... improve quality on your toughest production jobs.

DENISON ENGINEERING DIVISION American Brake Shoe Co.

1254 Dublin Road . Columbus 16, Ohio

HYDRAULIC PRESSES
PUMPS · MOTORS · CONTROLS

DENISON

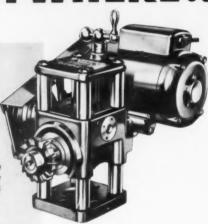
HYDRAULIC MULTIPRESS

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MACHINE ANYTHING ANYWHERE....



Compact, rigid, easy-to-move units in three sizes for all tooling needs. Perform in any position. Built-in power and feed. Priced from \$595, FOB Racine.



ONE DUMORE VERSA-MIL plus lathe equals a complete machine shop

- save handling, moving set-up and down-time
- one unit often pays for itself on one job
- provide close tolerance quality at profitable metal removal rates up to 1-1/2 cubic inches per minute in mild steel
- give you the advantage of machining where it is most economical—by letting you take the machine to the work

YOU CAN DO MORE WITH



PORTABLE PRECISION METALWORKING TOOLS

THE DUMORE COMPANY
1300 Seventeenth Street, Racine, Wisconsin

1300 Seventeenth Street, Racine, Wisconsin MI-SPEED DRILL UNITS - DRILL-N-TAP UNITS - DRILL UNITS - DRILL HEADS - MICRO-DRILLS - DRILL GRINDERS - TOOL POST GRINDERS - HAND GRINDERS - FLEX-SHAFT TOOLS - QUILLS AND ACCESSORIES - VERSA-MIL UNITS



When you have a need for erector-type components for special machines...machining heads, feed tables, machine beds...contact our subsidiary Master Manufacturing Company, Hutchinson, Kansas.



YOUR DUMORE DISTRIBUTOR HAS COMPLETE STOCKS FOR FAST DELIVERY

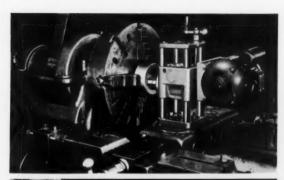
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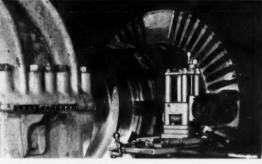
... machine tool attachment

Dumore Versa-Mil combines with any standard machine tool for secondary machining operations.

AT LOWER COST

MILLS
BORES
SHAPES
SLOTS
GRINDS, DRILLS
and related
machining





... portable machining unit

Built-in power and feeds, plus any position mounting, permit Dumore Versa-Mil to in-place machine parts or machinery too big to move or handle in standard machines.



... component for special machines

Dumore Versa-Mil adapts readily to special machining set-ups for production applications. Completely engineered accessories and attachments provide versatility for a variety of operations.

SEE HIM FOR A DEMONSTRATION...OR WRITE FOR BULLETIN VM-60-C

For more data circle 347 on Postpaid Card

December, 1961

MODERN MACHINE SHOP



ONE WORK SET-UP

lets you Mill, Drill, Bore, Ream, Shape

. At all angles! And from all angles, this Clausing vertical miller is perfect for production, layout, and light jig-bore work.

Not only is it versatile. Factory tests verify the accuracy of each Clausing to within tenths! A report showing exact indicator readings accompanies your machine.

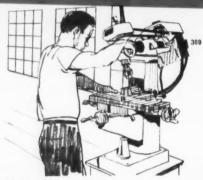
And it's efficient!" ... Easiest to set up, get around, and operate ... with sensitivity you don't get in larger machines—a mighty important factor when using small cutters."

Yes, from all angles, the Clausing V-Mill is an unmatched machine tool with an unmatched low price. Ask your Clausing dealer to prove it! And write for catalog today.

CLAUSING

DIVISION OF ATLAS PRESS COMPANY

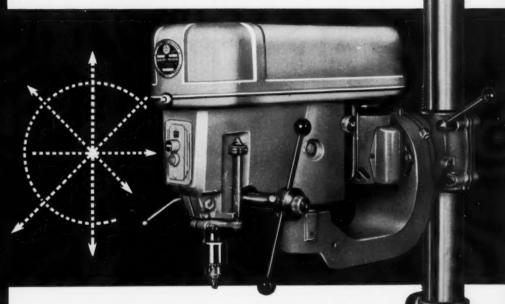
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NEW Walker-Turner Unidrill*

GIVES YOU 5-WAY FLEXIBILITY



With the Unidrill you can position the cutting tool to the work in five different ways—move and tilt the drill head to speed the operation, reduce set-up time and eliminate expensive jigs. It's a 2-foot arm radial drill press designed to handle problem drilling jobs—angular drilling, heavy work, bulky pieces.

You can do reaming, spot facing, counter-boring and many other jobs. The Unidrill offers six interchangeable spindles or spindle adapters plus a 12-speed multi-speed attachment that provide even greater versatility.

Ask your Walker-Turner Distributor (listed under MACHINE TOOLS or TOOLS in the Yellow Pages) to show

you how the Unidrill can drill to the center of a 48" circle.

FREE BROCHURE shows the full Unidrill line. Write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WM-22, 400 N. Lexington Ave., Pittsburgh 8, Pa.

* Trademark

WALKER -TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS

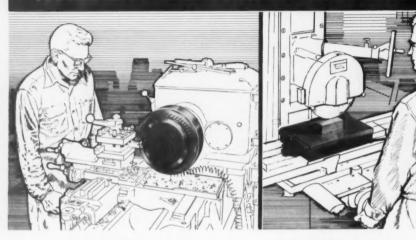
another fine product by

ROCKWELL



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WALKER CERAMAX CHUCKS



TURNING

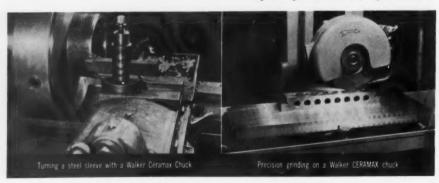
Walker, for the first time in machine tool history, offers safe magnetic holding for lathes. Ceramic magnets in Walker Rotary CERAMAX chucks are not subject to electrical power failure and have three times greater coercive force than ordinary Alnico magnets. With uniform holding power over the entire face of the chuck, safe, accurate turning, facing or trepanning is accomplished in a single set-up.

For dependable, trouble free operation specify Walker CERAMAX Chucks.

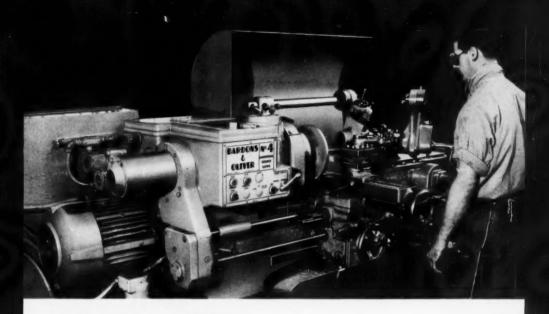
GRINDING

Walker CERAMAX chucks provide all the holding power needed for standard grinding operations and with fine pole divisions are ideal for thin, small work as well as large, heavy pieces. All-steel top plate minimizes redressing to reduce non-productive machine time. Ceramic magnets retain magnetism permanently, eliminate constant recharging.

OSIVALE Co., Inc.
ROCKDALE ST. • WORCESTER 6, MASS.
Original Designers and Builders of Magnetic Chucks



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BARDONS & OLIVER NO. 4 TURRET LATHE

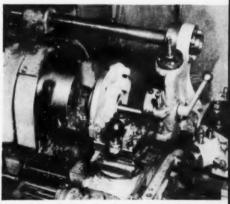
"Biggest Money-Maker in the Plant"

Reports W. W. McCain, Jr., Factory Manager, Chicago Machinery Laboratory, Inc. This progressive firm manufactures automatic signature feeders and magazine trimmers. Mr. McCain further states:

"The addition of the No. 4 Bardons & Oliver has allowed us to reduce direct labor in the turret lathe department, and at the same time increase output by 50%. Over 600 different parts are made on the machine. Extreme accuracy of the No. 4 allows us to hold bearing diameters within ±.00025"; at the same time high spindle speeds, heavy feeds, and combined and multiple cuts allow full utilization of the 15 HP main drive motor. The machine is very convenient to setup and operate. During two years of 100 hours a week operation, dountime on the No. 4 has been negligible.

We feel that the Bardons & Oliver No. 4 is the most compact and efficient turret lathe available having 18" swing over the bedways. By making a totally different turret lathe for each range of work, Bardons & Oliver offers just the right size machine for any job."

Your Bardons & Oliver representative will welcome the opportunity to discuss with you the profit possibilities offered by these turret lathes.



Rough turning & boring 11-1/2" O. D. cast iron cam follower wheel.

BARDONS & OLIVER

For more data circle 351

BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes



Nobody wants a jig borer without numerical control!

Well, almost nobody-



We sell eight Fosmatics with numerical control for every one we sell without it.

You know where they go? Out on the production line, replacing jigs by machining parts directly to tolerances measured in tenths.

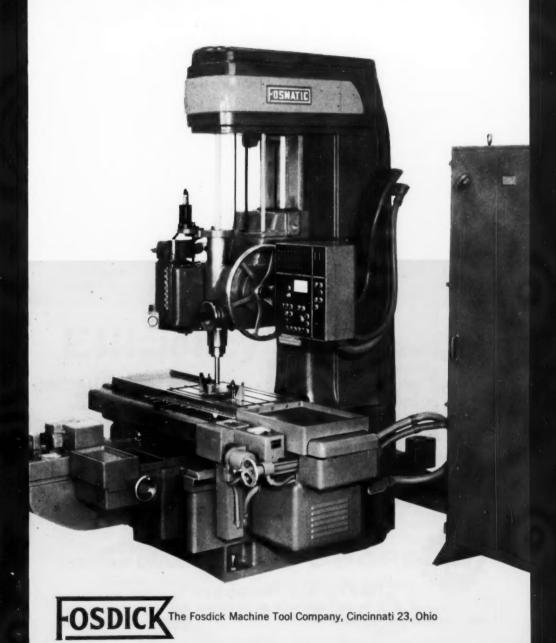
At first customers thought in terms of numerical control for table location only. Now they want it for head height control, depth control, tool changing. The works. All around them they're seeing numerical control paying off.

You can have numerical control now on all Fosmatic Jig Borers (table sizes from 32 to 54 inches). Competition will tell you that now is the right time.

For numerical control now, get a proposal from Fosdick.

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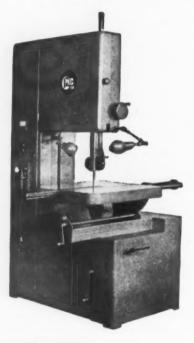




GROB SPELLS THE DIFFERENCE IN BAND SAW MACHINES

The new GROB 24" universal band saw has all the famous GROB features:

Quality • Efficiency • Durability • Strength Utility . Low Maintenance . Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing
- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP
- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

Write GROB INC. for complete specifications

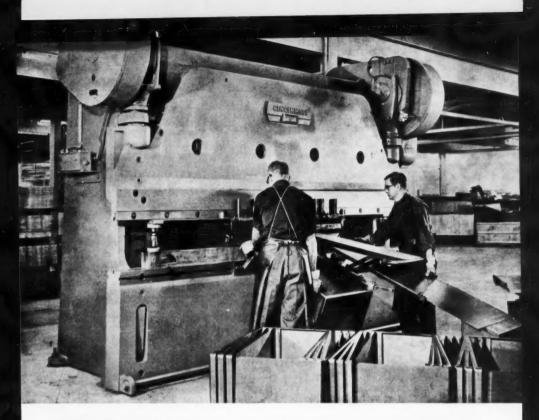
GROB also manufactures a complete line of:



BUTT WELDERS FILING MACHINES GEAR ROLLING MACHINES

GRAFTON, WISCONSIN

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Efficiency jumps 50%

CINCINNATI® PRESS BRAKE FORMS PROFITS FOR STEELCASE

50% more efficient than previous method, this 225/150-ton Cincinnati forms four radius corners on pedestal bodies. "High degree of accuracy and convenient operation," according to Steelcase, help operators produce 80 pieces per hour. The machine operates more quietly and takes less floor space than their previous equipment.

THE CINCINNATI SHAPER ...

Shapers / Shears / Press Brakes Cincinnati 11, Ohio, U.S. A.



In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow
For more data circle 354 on Postpaid Card



Cintimatic drill brings tape control to a 7-man shop

You don't have to be a giant to gain big savings through numerical control. A small, seven-man shop located on the eastern seaboard has demonstrated this fact over and over with a recently installed Cintimatic Drilling Machine.

Numerically controlled with tape programming, the new unit permits high production while maintaining positioning accuracy with uniform tolerances. It also eliminates need for costly drilling jigs and minimizes set up time. What is more, ACRAMATIC control reliabil-

ity permits use of Cintimatic Drilling Machines in any shop—even those which do not have a high level of electrical maintenance.

Cintimatic Drilling Machines may prove to be your answer to fast-production job-lot drilling needs. Base price: \$14,500, complete, including ACRAMATIC Control. Price subject to change without notice.

Write for complete details and specifications. Cincinnati Lathe & Tool Company, subsidiary of The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



CINCINNATI



SINGER Numerical Control eliminates layout of the piece, center punching and positioning by hand. Information can be typed out and checked before the part is even available for machining, eliminating all lead time. The SINGER unit provides accuracies of $\pm.001$ on a work table with 40" or more of motion, and up to $\pm.0002$ where closer tolerances are required.

AND SINGER NUMERICAL CONTROL CAN ACCOMPLISH ALL THIS AT AS LITTLE AS 1/2 THE COST OF A CONVENTIONAL SYSTEM

For further details and an appointment to visit the SINGER NUMERICAL CONTROL DEMONSTRATION ROOM, write to the address below.



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YOU CAN'T ...BEAT A... BULLARD.



to cut costs when cutting metall

MULT-AU-MATIC, Type "M" Available with 6, 8, or 12 spindles.



MULT-AU-MATIC, Type "L" 14" and 18" with 6 or 8

10" with 6, 8, 12, or 16 spindles, spindles.



In 3", 4", and 5" spindle size. Many combinations of bed length, table size and vertical travel.

Before you buy, investigate the many outstanding features and advantages offered by modern Bullard Machine Tools.

Day-in and day-out - they are proving their ability to produce more in less timethereby reducing the cost per piece.

For the complete cost-saving story, call your Bullard Sales Office or write

THE BULLARD COMPANY BRIDGEPORT 9, CONNECTICUT

DYNATROL V. T. L.

26" to 86" in 10" increments. Discrete positioning or contouring numerical control system can be applied.



L BORING & TURNING MILL

or fully automatic operation, can be applied to any or all heads of Dynatrol at time of ordering or at

later date.



108", 124", and 144" table sizes. Discrete positioning or contouring numerical control system can be

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54



LIVE CENTERS

UNIVERSAL models for super accuracy to .0001, high load capacity, perfect for grinding and other high-precision work



meet most turning needs at lowest center point cost

Over 40 sizes...with all popular tapers... in four styles... to choose from. That's how Ideal helps you meet your turning needs for the heaviest work to the lightest of light jobs.

Ideal Live Centers are guaranteed to provide the highest accuracy required, exactly matching the lathe size you use. What's more, they are custom quality designed and manufactured by production methods to give you the lowest possible precision center point costs.

You can get Ideal Live Centers from your distributor's stocks. He'll give you immediate delivery service—which reduces your inventory requirements and cuts your investment costs. If you need a special, we'll be glad to work with him to meet your specifications at the right price.

MULTI-DUTY models for general use, perfect for light work, interchangeable parts provide quick changeover for multi-purpose operations.



HEAVY-DUTY models for extra rugged work, give close tolerance results where high load capacity is required, accurate



PIPE POINT models for cylindrical turning of pipe, axles and other hollow shapes, six sizes from 31/4" to 71/2" dia.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS
In Canada: IRVING SMITH, Ltd., Montreal

Write for new LIVE CENTER Catalog

IDEAL INDUSTRIES, Inc., 1031-L Park Avenue • Sycamore, Illinois

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- 15 tons C-type (also 22 ton, 30 ton, and 50 ton models).
- 3 speed ranges: 300-900 spm, 350-1050 spm, 400-1200 spm.
- ½" to 1" stroke.
- 91/2" x 14" bolster; side-to-side feed.

Ball bearing gibs-no heating problems and no lubrication problems. Dynamically balanced. Minimum vibration. Heat treated SAE 4140 forged crankshaft. Extra rigid welded frame. Aluminum ram. Control console standard equipment. Close control of inching at high speed. Write now for full facts.

Precision Welder & Flexopress Corporation 3520 Ibsen Ave., Cincinnati 9, Ohio

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MODERN MACHINE SHOP

December, 1961



CUTTING FLUID COSTS GO DOWNHILLI

Reasoning is simple—with STUART'S DASCO 950 and water, you can now replace many of the sulfurized or sulfo-chlorinated straight oil type cutting fluids you're now using to perform the tougher operations on materials in the medium to severe range of machinability: low carbon steels, alloy steels, stainless steels, and high temperature alloys.

To replace these straight oils, use DASCO 950 and water for: tapping and threading—spline and contour broaching—gear shaping and generating—gear hobbing, automatic bar and chucking machine work, or where high surface finish requirements prevail on drilling, milling, reaming,

boring or lathe operations performed on soft, tough, stringy materials.

DASCO 950 provides effective anti-weld protection in the form of a very active type sulfur, as well as protection against excessive front clearance wear as a result of its two chemical lubricity additives.

Furthermore, you're insured against rough finishes due to chip welding or excessive built-up-edge. You gain proper chip formation, savings in tools through less frictional wear and cooler cutting.

If you're interested in **replacing straight oils**—reducing cutting fluid costs—improving job performance, contact us!





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PLUS WATER... SCOT FREE WATER



Stuart

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December, 1961

MODERN MACHINE SHOP

57





HOLE SAWS





Most informed buyers know that, despite all the drum beating about brand superiority in metal cutting products, all of the several top brands are amazingly close in both price and quality.

We frankly admit that Clemson Star is no exception, and therefore refuse to guarantee that Star products, though high in quality, are "cleaner cutting," "far more efficient," or "longer lasting," than all others on the market. Nor will we make any wild claims about our service or delivery being more complete or expedient than that of our most conscientious competitor. What we do say - and guarantee - is that every Star product you purchase from your local Clemson Star distributor will do exactly what he and we say it will do. That it will come to you at a fair price, as promptly as possible, and with the solid backing of an old, established and reputable American company, goes without saying.

The only thing that may be unique about Clemson Star is the absence of fantastic claims. And that's policy!

CLEMSON

CLEMSON BROS., INC. . MIDDLETOWN, N. Y. . METAL CUTTING PRODUCTS For more data circle 361 on Postpaid Card



3028



MICRO-TURN'
HIGH SPEED PRECISION LATHE

*TM Reg. U.S. Pat. Off.

For more data circle 362

you may be overlooking one of your best opportunities to

REDUCE INDIRECT COSTS

There are over 7,000 types and sizes of Apex Nut Running and Screwdriving Tools, for use with all popular makes of air and electric power tools.

NUT RUNNING TOOLS Catalog 30-A-

1/4", 1/2", 3/8", 1/2", 5/8" square drives, 1/4", 5/4", 1/4", 5/8" hex drives.

Catalog 30-B-

 $\frac{3}{4}$ ", 1", 1¼", 1½", 2½" square drives, ½", $\frac{5}{8}$ ", $\frac{3}{4}$ " hex drives. Spline Drive.

Catalog 30-D Specials.

SCREWDRIVING TOOLS
Catalog 30-C—
Standard and Magnetic.

In your search for new ways to reduce indirect costs, take a closer look at your fastening tools. These are most likely the busiest tools in your plant, in use hour after hour, day after day . . . and every use offers an opportunity to reduce indirect costs.

Apex fastening tools will help you cut costs every time you drive a screw or run down a nut or bolt. Each Apex tool is designed for use with a specific type and size of fastener. The tool fits the fastener properly, insuring smooth, firm assembly without harming the product or wearing down the tool.

Each Apex tool is carefully heattreated in Apex' own metallurgical department, insuring the correct degree of toughness and resiliency for your specific application. And every Apex fastening tool is built for continuous, production line use, insuring longer service life with far less downtime for replacement.

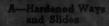


FASTENING TOOLS

SCREWDRIVING . NUT RUNNING . SPECIAL

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B Composite Die Sections

C-Heel Block

D-Center Clad

E-Flange Slide

save save Save with

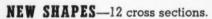
OHIO KNIFE CO.

A ALL

hardened ways and wear plate

For FREE copy of 16-page Bulletin-A, giving complete data on OK ways, etc., write Dept. 123-H H

THE OHIO KNIFE CO. CINCINNATI 23. OHIO



NEW USES—for dies, die sections, flange sections, ways, gibs, rails.

88 SIZES—every practical width and height up to 168" length.

65-66 ROCKWELL—to full depth of tool steel along entire length.

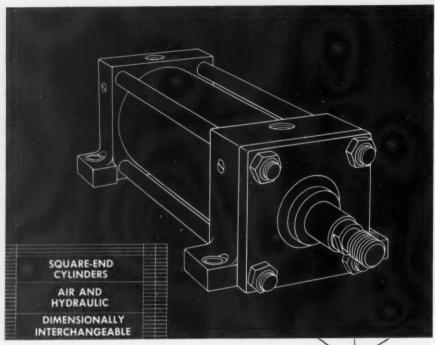
READY TO USE— delivered with cutting, forming, wearing surface machined, hardened and ground. Soft steel backing quickly drilled.

LOWER PRICES—production in large quantities enables us to price them below yours or other makes.

DELIVERY FROM STOCK — to

five weeks on all sections including clad aluminum bronze.

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How MEAD takes the BUMP out of high-speed pistons



FULL FLOATING CUSHIONS

Detail shows two-stage feature of full floating cushion on a piston used for hydraulic pressures over 250 psi. MEAD Square-End Cylinders also offer these other design advantages:

- Seamless, hard drawn, micro-finish brass barrel for long piston seal life
- Cold drawn steel cylinder heads with all surfaces permeated with black
- oxide for rust resistance

 High tensile chrome plated steel piston rods
- Accurately machined rod bearing cartridge made of solid bearing bronze

Special full floating cushions in new MEAD Square-End Cylinders are uniquely mounted on springs rather than on solid studs. The result is a smooth, high-speed piston advance without the use of ball checks. In hydraulic units, the two-stage design of the floating cushions completely eliminates bumping. Fully adjustable from the slightest measurable cushioning effect to complete stoppage, the full floating feature also reduces cushion wear caused by impurities in the working medium. In air models up to 250 psi and hydraulic units up to 1000 psi, mead Square-End Cylinders are available in a full range of bore, stroke and piston sizes. Complete selection of mounting styles. All units are dimensionally interchangeable and conform to JIC specifications. For consultation and information on quick delivery and competitive prices, write to Mead today.



A DIVISION OF MEAD SPECIALTIES CO.
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ASK YOUR MEAD MAN about 24-hour service on most MEAD products . . . 48 hours on special orders.

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The Payoff is <u>Performance</u>



G-E Man-Made diamond checks low output, high costs







This is just what you can do when you use metal-bond grinding wheels containing type MBG General Electric Man-Made diamond. A blocky, tough crystal, G-E type MBG Man-Made diamond has been developed especially for metal-bond grinding wheels. Case in point:

In a production test involving electrolytic grinding of more than 311,000 miscellaneous carbide tools, 6 wheels with G-E Man-Made diamond were compared with 6 wheels containing natural diamond.

E	LECTROLYTIC	GRINDING	PERFORMANCE	
Diamond Type	Average Wheel Wear Inches	Average Cubic inches Carbide Remand	Avg. Cu. In. Carbide Removed Per Cu. In. Wheel Wear	Efficiency Ratio
G-E MBG	.0605	90.885	70.2	122.5
Natural	.0644	80.181	57.3	100.0

Results: a 22.5% superiority for G-E Man-Made diamond over natural diamond! Let your own tests validate the benefits of G-E Man-Made diamond in your metal-bond grinding operations. You'll find the payoff is performance. Call your wheel supplier soon.

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL (88) ELECTRIC



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"Dollar for Dollar The Minute Man" Keyway Broach Kit is one of our Soundest Investments"



We cut keyways in one minute—often for less than a penny apiece. Wide range of sizes, too, from 1/16" to 1" in any bore from 1/4" to 3".

You, too, can banish costly machine tool setting up with Standard Minute Man Keyway Broach Kits. Stock broaches for square, round and hexagonal holes save time and money, too. Send the coupon for more facts.

SQUARE BROACHES 1/4" to 1" square holes

HEXAGON BROACHES %" to %" hexagon holes

ROUND BROACHES 14" to 1" round holes

The duMont Corp., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST 8 describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

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Meetings

Important Meeting Dates

DECEMBER 2-5 • Annual International Visual Communications Congress, Biltmore Hotel, Los Angeles, Information: John E. Sedan, 18465 James Couzens Hwy., Detroit 35, Michigan.

DECEMBER 3-6 • American Institute of Chemical Engineers, Annual Meeting, Hotel Commodore, New York. Institute headquarters: 25 W. 45th St., New York 36, New York.

headquarters: 25 W. 45th St., New York 36, New York.

DECEMBER 6-7 • American Society of Tool and Manufacturing Engineers, Electro Metal Removal Seminar, Statler Hilton Hotel, Hartford, Conn. Society headquarters: 10700 Puritan Ave., Detroit 38, Michigan.

DECEMBER 6-8 • Metallurgical Society of AIME, 19th Electric Furnace Conference, Penn-Sheraton Hotel, Pittsburgh. Society headquarters: 29 W. 39th St., New York 18, New York.

JANUARY 22-25 • National Plant Engineering and Maintenance Show, Convention Hall, Philadelphia. Information: Clapp & Poliak, Inc., 341 Madison Ave., New York 17, New York.

MARCH 12-13 • Steel Founders' Society of America, Annual Meeting, Drake Hotel, Chicago. Society headquarters: 606 Terminal Tower, Cleveland 13, Ohio.

APRIL 9-13 • American Welding Society, Annual Convention and Welding Exposition, Sheraton Cleveland Hotel and Cleveland Public Auditorium, Cleveland. Society headquarters: 345 E. 47th St., New York 17, New York.

APRIL 25-29 • Western Space Age Industries and Engineering Exposition, Cow Palace, San Francisco. Information: Lykke-Wilkins & Associates, 681 Market St., San Francisco 5, California.



Some people baby their carbide tools. They hold back a little on roughing cuts, because they've heard carbide is pretty brittle . . . and some of it is. Or they ease off on finishing cuts, because their tool may be too soft for long, fast passes . . . because it may wear or crater. And, some of it will.

But this is "paring-knife" machining, and it really isn't necessary.

Not any more . . . not since Carmet introduced the 700 Series Steelcutting

Grades. No paring knife made these chips . . . these were hogged out

on a production basis by one of Carmet's new carbides . . . Grade CA-720.

The job: rough facing railroad axle forgings in an automatic tracer lathe $-210~\mathrm{sfm}-.076''$ feed -114'' width of cut. The result: over 1,000 cubic inches of steel removed in 512 minutes, floor to floor, with plenty of red hot chips like these. And, 35 axles per tool against 25 pieces for the best competitive carbide tool . . . a tool carrying a higher price tag.

Carmet's 700 Series have the edge wear and crater resistance, and the ability to endure shock and heat, to breeze through jobs like this. They're doing just that all over the country... right now! Next time you're setting up a mean, tool-buster of a cut, let the 700 Series make chips and money for you, just once. Your Carmet Distributor has the local stock and all the information. Call him, or write: Carmet Division, Allegheny Ludlum Steel Corporation,



CEMENTED CARBIDE - DIVISION OF ALLEGHENY LUDLUM For more data circle 368 on Postpaid Card NEW W

from

NORTON N



CUT-N-SAUCER wheels with DIS-CARD mounts

A new combination from Norton's newest plant

For easier, faster weld-grinding, light snagging and many other portable grinding jobs, Norton now offers you:

The only reinforced wheels that combine a saucer shape with a disposable mount.

These are the new BSA Type Cut-N-Saucer wheels with Dis-Card mounts . . . available in 7" and 9" diameters. They are produced in the big new Norton Plant 8, built specifically to improve the manufacture and performance of resinoid wheels.

Reinforced with layers of fibre glass, BSA Cut-N-Saucer wheels gain added advantages from the new shape. Compared with straight wheels, BSA wheels on the job can be held at angles much closer to the horizontal. Results are easier control and reduced operator fatigue.

The Dis-Card mount is equally new and vital. Unlike ordinary mounts it is no separate attachment. It is permanently secured — designed to be bought and thrown away with

every wheel. This means you can change wheels in seconds — completely eliminating "lock washer" action and the usual mounting routine that can take up to half an hour. So every Cut-N-Saucer wheel you buy is already mounted — and stays mounted, throughout wheel life.

Yet you pay no more for a Norton Cut-N-Saucer than for a conventional reinforced wheel!

Cash in on this first opportunity ever offered to you to get advantages never before combined in a single, standard priced, portable grinding wheel. For further facts on the new BSA wheels — or on straight wheels also with Dis-Card mounts — see your Norton Distributor, or write to Norton Company, General Offices, Worcester 6, Mass. Plants and distributors around the world.



W-201

Making better products...to make your products better NORTON PRODUCTS: Marsinus - Einsting Wiesls - Machine Tools - Refractories - Nos Stop Floors - BERR MARRINE BIVISION: Couled Abrasins - Stargeoing Stones - Pressure Sensitive Tapes

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Barrel-finishing is best finishing

to cut costs of your machine parts

It's common knowledge that barrel-finishing is now the one outstanding way to cut costs and improve the appearance of mass-produced parts.

If you're missing these production advantages because you've felt your own particular machined parts may be too delicate and complicated... too big and heavy... or not the right material... this message is for you!

The fact is that barrel-finishing with Norton TUMBLEX* abrasives is your surest, quickest way to remove burrs, provide uniform radii, improve surface finish and increase the fatigue strength of the parts you are machining.

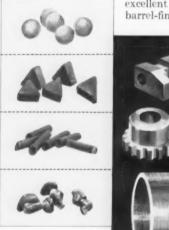
The variety of materials, sizes and shapes covered is practically unlimited. Materials include ferrous, non-ferrous, and modern space alloy metals — also plastics and many other non-metallics. In sizes, anything from tiny roller bearings to aircraft wing spars can be handled. And shapes can be the most complicated ever processed.

For your product's eye-appeal, barrel-finishing provides excellent finish. Lower handling costs are assured by the barrel-finishing ability to combine several operations — de-

burring, breaking sharp edges, surface finish refinement, etc. — at the same time. In addition, your barrel-finished machined parts can be plated without burnishing or buffing—and welded or brazed after simple cleaning.

Get complete proof. Send sample parts to our Sample Processing Department. We'll barrel-finish, return samples and report the methods and abrasives you need for new production advantages. NORTON Company, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries



Barrel finishing your own machined parts with the right

TUMBLEX abrasive improves their quality and appearance. And this faster finishing can cut your cost-per-piece produced.



G-420

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors

BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

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modern machine shop

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DIAMOND MANDRELS for precision grinding

You can grind small diameter holes in hardened, heat sensitive steels, carbide, ceramic, ferro-ceramic material, and glass. Shanks are hardened and ground accurately. Diamonds are mounted under controlled atmospheric conditions by a patented new electronic method, assuring their maximum retention. The sharpest edges of the diamonds protrude for rapid stock removal. Widely used on jig and internal precision grinding. Available in a complete range of sizes from .018 inch to .750 inch in diameter.

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PRECISION DIAMOND $P \longrightarrow t$ TOOL CO.

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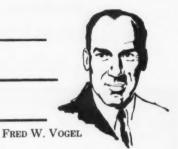
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December, 1961

MODERN MACHINE SHOP

69

OVER THE EDITOR'S DESK



TOOL AND DIE CRISIS

In order to keep abreast of the latest developments which appear to be seriously affecting the nation's Tool and Die industries, we asked Gilbert C. Close, our Field Editor, to sit in on a recent Association meeting. The following is his report as he submitted it for the readers of Modern Machine Shop.

"We are living in a time of tremendous and fast-moving change. Long-established, accepted principles give way to new ideas, developments and methods. This is particularly true in the revolutionary scientific and technological advances of the industries upon which NTDPMA members depend for their business."

This rather solemn warning served as the opening paragraph in a new Five-Year Plan submitted for approval at the recent annual meeting of National Tool, Die & Precision Machining Association, in Pasadena, California. Representing more than 1000 firms across the nation engaged in special tool, die and precision machining work, the main subject of discussion at the

meeting was survival in the face of current and impending technological advances.

A decline in special tooling requirements by American industry during the next five years, and the need for major shifts in management concepts to offset it by the plants providing tools and dies was forecast to the members.

A special committee of tool and die industry leaders presented these conclusions to the Association's Board of Trustees in a comprehensive 1961-66 program for dealing with the changing conditions that face approximately 4,000 companies which build the tools, dies, jigs, fixtures, gages, molds, precision-machined parts and special machines for the nation's mass production industries.

"There is every indication," the report states, "that the volume of tool and die work will not keep pace with the overall growth of industry and our national economy in general. As a matter of fact, tooling requirements are declining and will continue to do so.

"Some reasons for this decline are the imports of foreign products

SUPERMARKET



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December, 1961

MODERN MACHINE SHOP

71

which contain hidden tooling, standardization of interchangeable parts in the automotive and appliance fields, and an increasing emphasis on tape-controlled machines." In this case "hidden tooling" refers to the dies and other tools which are made in the country from which the foreign-made product is imported.

While emphasizing this major shift in the volume of the classic types of work performed by contract tool and die plants, the report pointed the way to new roles in the economy for these companies, "provided new skills and equipment are acquired in order to give efficient and

satisfactory services."

It went on to explain that currently, the major portion of manhours worked and the sales volume of the 1,000 member firms of the Association centered around special tool and die work. It then explained how this emphasis would have to be shifted.

"All indications point to the fact that the next decade will see a tremendous increase in high precision and prototype work required in connection with new developments. In both industry and science, research is receiving more attention and a larger budget every year. Special machines and special machinery are required in larger volume, and it is believed that these requirements will continue to grow. thereby accounting for a larger proportion of the man-hours and sales volume of the contract tool and die industry."

One speaker pointed out that this trend toward special machines

rather than special tools was already vividly apparent in the Southern California aircraft industry, and throughout the electronics industry as a whole.

To keep pace with the future, the report charted definite changes and improvements that would have to take place within the tool and die industry itself. These included the development of new skills for working with unfamiliar materials and closer tolerance requirements: greater knowledge of financial management and a breakaway from the "family held" status which characterizes so many companies in the tool and die industry; retention and additional training of key employees: more intensive sales promotion programs; and the acquisition of a product or line of products which can be efficiently manufactured and produced with the company's currept manufacturing facilities.

Summed up briefly, the report pointed out that during the next five years the trend would be away from special tool and die work and toward the production of specialized machines and high precision parts and products.

Officers elected for the forthcoming year for NTDPMA included John D. Dewhurst of Arrow Tool Company, Inc., Wethersfield, Conn., president: Rolf H. Berg of Atols Tool & Mold Corporation, Schiller Park, Ill., first vice president: Fred D. Wright of Fred D. Wright Co., Inc., Nashville, Tenn., second vice president; DeWitt L. Bills of World Tool & Engineering Co., Minneapolis, Minn., treasurer; and David J. Bathgate of Oval Tool & Die Corp., Detroit, Mich., secretary.

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- PRESIDENT KENNEDY IS SOFT-PEDALING HIS NEW FRON-TIER these days . . . only temporarily. The pressure of events is forcing him to veer over toward the middle of the road. The Berlin crisis and a Congress that grew increasingly balky at the end of the last session have led him to play down some of his pet projects—the programs that were to give his term so much of its flavor. Kennedy regrets the need to go more slowly, but he's always been an intensely practical politician, ready and willing to face reality. So . . . until foreign and domestic conditions change . . . you will see new concern about what programs cost.
- THE WHITE HOUSE HAS ORDERED CUTS IN NONDEFENSE SPENDING "wherever possible"—to keep the deficit for the current fiscal year from exceeding the \$7 billion just estimated. President Kennedy is acutely aware of the danger of inflation and gold losses that rising deficits can bring. But he is discovering—as Eisenhower did before him—that spending is hard to cut. The government has lost control of many kinds of spending. Farm aid depends on harvests. GI benefits and debt interest are fixed. And people don't want to trim health research, postal services, or highway work. Some outlays can be cut, but they don't account for a big part of the total. Indeed, rising defense spending also threatens next year's balance.
- THE BUSINESS OUTLOOK IS STILL VERY PROMISING, despite the soft spots that have cropped up in the past month or two. More than a few economists were disappointed by the consumer's sluggishness in

stepping up his rate of buying. But now they think they see the start of an upsurge in retail sales. So the experts still look for a fast finish to 1961, and good gains in 1962. The slowdown that started in September was only temporary. It reflected a combination of negative factors not likely to recur—auto strikes . . . unseasonal weather . . worry over Berlin. Economists now feel the lull began to end several weeks ago. Recent good business news is adding strength to the earlier confidence in the soundness of this recovery. For example: New orders for durables are the best in more than two years. Personal income is rising and is now \$15 billion over 1960. Sales of 1962 autos . . . vital to all business . . . started strong. Housing starts have finally turned and now top 1960 by 26%. Meanwhile, prices are stable and U.S. spending keeps rising.

- ECONOMISTS ARE LIFTING THEIR ESTIMATES OF PROFITS, as one result of the business upturn. The sharp increases in productivity that normally come with a recovery are fattening margins—more so than many businessmen have been realizing. These days, \$47 billion is considered fairly conservative for 1961—up \$2 billion over 1960. Actually, earnings are doing better than this: In the fourth quarter alone, the rate will top \$50 billion a year. First corporate reports for the third quarter show some big gains over the comparable period of 1960. Steel, up over 50%... railroads, 40%... metal products and office equipment, 30%... coal, 15%. There were dips, too—small ones, however.
- THE TREND IN PLANT INVESTMENT IS BECOMING A BIG WORRY of economists. Spending for new plant and equipment has recently turned up . . . moderately. And still further increases are expected as the recovery moves on into 1962. But the fear is that the gains won't be big enough to keep up the momentum that was first generated by increases in federal outlays and in inventories. The experts figure that it will take at least a 10% rise in this dynamic force to keep the recovery rolling after the middle of next year. Surveys don't promise this big a jump, which is why forecasters are concerned. But they still feel that the surge will come. They note that most surveys taken early in a recovery tend to under-estimate future spending.
- THE FEDERAL TRADE COMMISSION WILL KEEP POLICING PRICES vigorously—the Administration's efforts to woo business notwithstanding. Kennedy has now appointed three of the agency's five members, so that it possesses a liberal orientation. This is showing up in its policies

Report from Washington . . .

... both current and potential ... which are charting new paths, putting industry on the defensive. One recent FTC ruling will make it harder for companies to plead "good faith" to justify their price cuts. In a 4 to 1 decision, the Commission held that competitive price slashes made to attract new customers—not just to hold old ones—constitute unlawful discrimination. If the courts uphold it, price-cutting will be illegal in a broadened range of cases. FTC officials also plan to push for power from Congress to issue ... on their own authority ... temporary cease-and-desist orders before completing their proceedings in a case Now, except for cases involving foods, drugs and cosmetics, FTC must make all its findings before asking the courts for an injunction. Backers argue that, currently, long drawn-out proceedings add to the damage to victims of misleading ads.

- CONGRESSIONAL INVESTIGATING GOES ON THESE DAYS... even during recess. Committee members are looking into a multitude of matters, many of them being substantially important to business. Some of the investigations are certain to lead to new legislation in '62. Here's a rundown of the most important. In the Senate, studies have begun—or will soon—on drugs, food packaging and labeling, sales of wartime alien assets, gambling, a U. S. fuels policy, communications satellites. In the House, probes will hit road scandals, impact of oil and other imports, poultry, Soviet schools, hiring policies.
- EUROPE'S GROWTH BY 1970 WILL CUT U. S. EXPORTS—to the area itself and . . . through stepped-up competition . . . to other parts of the world. That's one key implication of a huge study just completed by the 20th Century Fund. Europe's recent heavy investment in new plant may start slowing soon, but the expansion will still be big; ending internal tariffs will hurt us, too. The growth of incomes will swell Europe's demand for consumer goods. But many American companies will find that the best way they can cash in is to build still more plants overseas.
- AND DON'T EXPECT ANY MAJOR TAX ACTION BY CONGRESS next year. During the session that just ended, the legislators were very cool to the package that Treasury officials had proposed. House taxwriters were especially hostile. So the Treasury plans to pull in its horns and ask for only a few changes. Only if these are voted—say, by April—would Kennedy seek broad revision.

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December, 1961

MODERN MACHINE SHOP

modern machine shop-talk...a digest

of recent metalworking activity

Machine tool leasing is acquiring an added impetetus as the C.I.T. leasing corporation announces the expansion of its operations on a nationwide basis. Leasing plans with terms of five to ten years will be offered users.

Research is becoming a \$16 billion business according to Dr. George W. James of the Battelle Memorial Institute. Of this amount about \$10 billion comes from the government and industry furnishes another \$5.5 billion with universities and foundations accounting for about \$350 million. By comparison only \$3 billion was spent for research in 1950.

Nitinol, a new non-magnetic class of alloys, has been developed by the U. S. Navel Ordnance Laboratory at White Oak, Silver Spring, Maryland. Nitinol is corrosion resistant and can be hardened to 62 Rockwell C. It has a specific gravity of 6.45 and is suitable for use up to about 1200 degrees Fahrenheit. Nitinol is a combination of Titanium and Nickel and has good room temperature ductility.

That new air cooled, two cycle, multifueled engine developed for the Army Ordnance Corps by the Lycoming Division of Avco should rekindle speculation as to whether or not the traditional four cycle gasoline engine will eventually lose its dominance as the power plant for automobiles. Lycoming claims that the engine, which is as light and as compact as a conventional gasoline engine of equal horsepower, uses only 60 percent as much fuel. The loop scavenged design eliminates valves, valve springs, valve rockers, cam shafts and tappets. The engine is a compression ignition that uses electric glow plugs directly in the open combustion chamber for starting in extremely cold conditions. The four cylinder model with the complete cooling system and accessories develops 160 gross brake horsepower, weighs 600 pounds and occupies a space of 30 by 30 by 28 inches. It is made from an aluminum casting with a chromium plated cylinder bore.



The Speed King deceleration manifold controls double-acting cylinders on automated equipment moving masses weighing several hundred pounds . . . where rapid travel and precise, easily regulated cushioning, at any point in either or both directions, is required.

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DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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Shop-Talk . . . continued.

Two new ships in the Moore-McCormack Lines fleet, the SS Mormaccape and the SS Mormacglen, are equipped with all-welded aluminum deck houses and stacks which were prefabricated in the shipyard platen area and then hoisted aboard the vessels. Welding of the 30-ton deck houses was done automatically using the metallic-inert-gas-shielded-arc process. Base alloys for the deck, bulkhead plating, beams, stringers and frames are aluminum Type 5052-H32 and Type 5083-H112. These grades have high-strength-to-low-weight ratios and good corrosion resistance properties. Welding electrode wire used was Alumar 5356 supplied by Arcos Corp.

"In placing increased emphasis on missiles and space systems, the aircraft industry's major revenues will now come from engineering efforts in research and development—the direct opposite of the industry's past 'mass production' history" declares the firm of Arthur D. Little, Inc., Industrial Research Consultants.

Times do change. The Los Angeles Chamber of Commerce reports that electronics has taken the lead from the aircraft and parts industry as the number one industry in Southern California.

A semi-automatic gear-hardening device has been added to the toolroom facilities at Oldsmobile Division's plant in Lansing to shorten the time required to replace machine operating gears. The new device, by means of numerous high-temperature flame jets directed onto the face of the gear, quickly hardens the gear teeth to a depth of about one-sixteenth of an inch. Gears ranging to 16 inches in diameter are slowly rotated on a spindle and when the proper temperature is reached the spindle retracts and drops the gear into the quenching oil. The process takes about 40 seconds.

Japanese labor may be very low in cost but in order to maintain a competitive position in the world automotive market Nissan Motors' stamping plant near Tokyo is purchasing a six press automated fender line from Clearing Division in Chicago. The six 400-ton capacity presses will require only two operators for the entire line which will take individual sheets which are automatically fed into the press line and emerge as fully formed parts at the rate of 1200 units per hour. This is one of four press lines which will total 23 presses and cost about \$5 million.

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A Look at Electrical Discharge

Article provides a general picture of the process, how it works and its specific advantages.

By GILBERT C. CLOSE Field Editor, Modern Machine Shop

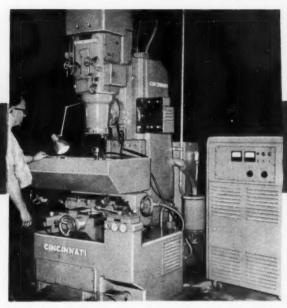
What is electrical discharge machining? How do these machines operate? What sort of tooling do they employ, and why? What are their major fields of advantage, and wherein are they specifically advantageous? Can a logical comparison be drawn between electrical discharge machining and the more conventional metal removal techniques?

With the thought in mind that only a relatively few shop people have had a chance to see an electrical discharge machine in operation, and even fewer have had a chance to explore its production and tooling possibilities, this writer set forth to secure dependable answers to the above questions. With this knowledge, some shops who have peculiar and unsolved metal removal problems may decide that the electrical discharge machine is just what they have been looking for.

To obtain dependable answers, The L. C. Miller Company, Monterey Park, California, was approached. L. C. Miller has been specializing in electrical discharge machining since the first machines became available. As a job shop, doing all sorts of work on all

occember, rior

Machining



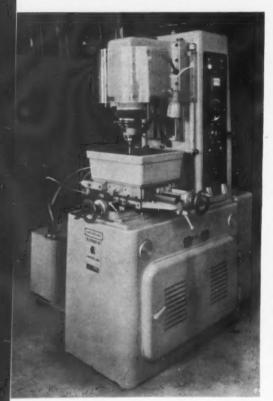
General view of a complete Cincinnati electrical discharge unit, including power supply, in operation. Note features for critical adjustment of both machine head and table. These adjustments are comparable to jig borer accuracy.

General view of electrical discharge machine line at L. C. Miller Co.

"Electrical discharge machining is used largely for producing cavities and odd-shaped holes."

sorts of materials, they have had ample opportunity to thoroughly explore all ramifications of electrical discharge machining. They are fully qualified to point out from firsthand knowledge how to use these machines to best possible advantage.

Mr. Miller's initial remark concerning the generalized usage of



Close-up of "Charmilles" electrical discharge machine which is used for highly critical work where jig borer-like accuracy is required.

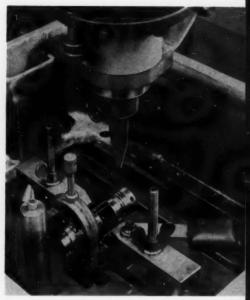
electrical discharge machining seemed at first to limit the field... "Electrical discharge machining is used largely for producing cavities and odd-shaped holes," he said. As it turned out later, this simplified remark encompassed such widely diverse operations as tap removal, the production of high precision and intricate internal threads, and crossporting two deep holes drilled in a solid piece of material!

"The basic principle of electrical discharge machining is often illustrated when an amateur mechanic installs his own auto battery," Miller explained. "If he happens to short across the battery terminals with his wrench, a hot spark occurs. If he examines the wrench after this sparking, he'll note that a small amount of metal has been burned away, leaving a very definite crater where the metal was removed. This is what happens in electrical discharge machining, except that the sparks are made to repeat many times each second, and the size and location of each crater as it is formed is controlled by the configuration of the electrode or tool and its relation to the workpiece being machined."

Miller went on to explain that from the physical standpoint the larger, precision-type discharge machines have a frame very similar to that of a precision jig borer. The head section in which the electrode or tool is mounted can be either manually or servo-adjusted through the x, y, and z axes, and the tool-



Setup for machining 1-inch radius to 0.001 inch accuracy on 8-pole Alnico magnetic. Table was servoed laterally against electrode while electrode and work rotated. Magnetic properties of magnet were not disturbed.



Setup for machining tapered fixtures in a weighing device for a wind tunnel. Slots virtually converted this component into a very accurate spring. Absence of all machining stresses improved quality of the part.

holder can be caused to rotate concentrically or eccentrically as desired. The table or bed of the machine on which the workpiece is mounted can also be manually or servo-adjusted through the three axes and tooled for controlled workpiece rotation. It is thus possible to obtain any desired starting relationship between the electrode and workpiece and maintain the desired relationship as machining progresses, either by manual manipulation or by servo control.

In operation, a properly formed electrode or tool is mounted in the machine head and the workpiece is clamped to the table. The current is then turned on, and the electrode

is moved toward the "start machining" point on the workpiece until the gap between them becomes so narrow that a spark (not an arc) jumps across. This initial spark occurs between that point on the electrode and that point on the workpiece which are closest together. But this initial spark causes a small crater to form on both the electrode and workpiece. This means that after the initial spark. two other points on the electrode and workpiece will be closer together. So the next spark occurs at these other points. The third spark occurs at a still different location and so on, with a net result that the spark gap distance between the

". . . discharge machining is usually accomplished under a dielectric fluid . . ."

electrode and workpiece is kept even within a few microinches at all times.

"To aid in maintaining a constant electrical resistance across the spark gap, and to flush away the products of spark erosion (the metal removed



This Elox Electron Drill, a typical electrical discharge machine, is used exclusively at Miller for tap removal. Here a large casting is being readily salvaged by tap removal.

from both the electrode and the workpiece), discharge machining is usually accomplished under a dielectric fluid," Miller points out. "This fluid may be oil, kerosene, distilled water, or any fluid with good insulating properties. Unless the products of spark erosion are continually flushed away, they may build up and bridge the spark gap, causing a "short" or variable gap distances which will give unpredictable results. The workpiece may be immersed in this dielectric fluid, or the fluid may be flushed over the sparking area from an auxiliary hose. In some cases, a hollow electrode is used to carry the dielectric and discharge it immediately in the sparking area."

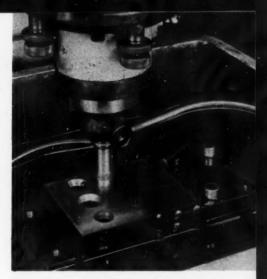
sparking area."
Miller next

Miller next explained how the repetitive sparks are obtained. A power panel plugged into the shop's normal a.c. power supply changes the a.c. to d.c. which in turn is voltage-adjustable by means of a voltage regulator. This d.c. power is then used to charge a capacitor at anywhere between 25 and 200 volts. Capacitance may vary from a few thousandths of a microfarad to 25, 30, or even 100 microfarads. It is the potential supplied by this capacitor which causes the spark to jump between the electrode and workpiece, and the capacitance of the circuit which determines just how much metal is removed by each spark. Of course, as soon as the capacitor discharges across the gap between the electrode and workpiece, it recharges again with a

speed determined by the power available. The spark thus becomes repetitive, occurring all the way from a few times a second to thousands of times a second, as desired to secure specific machining results. Low frequency "hot" sparks are used for rapid metal removal. Very high frequency and much weaker sparks are used for obtaining the finest surface finishes, as only an infinitesimal amount of metal is removed by each spark. Surface finishes down to 15 microinches are possible though slow to obtain. Surface finishes of from 30 to 60 microinches can be obtained quite quickly and economically.

Tooling, or the production of electrodes for use in discharge machining, is a rather specialized operation. To begin with, the electrode is a highly expendable item. This is because each time a spark occurs, a certain amount of metal is removed from the electrode as well as from the workpiece. The ratio of this removal usually varies directly with the hardness of the materials involved. Thus, when using a tungsten carbide electrode to machine aluminum, 20 times as much material might be removed from the workpiece as from the electrode with each spark: these figures would reverse when an aluminum electrode was used to machine tungsten carbide. The ratio of removal for best results and longest electrode life must be determined by experience.

Electrodes can be of practically any conducting material. Generally, one of the brasses are used. Other commonly used materials include copper, graphite, aluminum, molybdenum, tungsten, alloy materials.



Machining and countersinking holes in Rene 41. Hole is first machined by straight portion of the electrode and then the electrode is lowered until tapered countersink portion at top forms a spark gap with work.

and even steel. Here again experience is required as electrodes of different compositions will produce different results when used to machine different materials.

Because of their expendability, good electrode design must incorporate easy reproducibility. Some electrodes are made so that the eroded end can be cut off to re-establish tool dimensions. Other electrodes are made by hobbing so that reproducibility is simplified. Others are made of powdered metal. The dimensions of the electrode must always be small enough to include the spark gap distances between it and the cavity dimensions on which it is working.

Shape of the electrode must always be a counterpart of the shape of the cavity on which it is working, or in case the electrode or workpiece is rotated during machining, the path it traces must be a counterpart

"Extremely fine surface finishes and extremely close tolerances can be obtained . . ."

of the cavity shape. In the first case, a square electrode brought straight down against the work would machine a square hole. In the second case, an offset rotating electrode might be designed so that it would "trace out" and machine a snap-ring groove deep within a pre-drilled hole.

In discussing the general advantages of electrical discharge machining, Miller stressed three points:
(1) Heating is so localized (and so controlled by the dielectric fluid) that absolutely no machining stresses are induced in the part.
(2) As no cutting action is involved.

(2) As no cutting action is involved,

Machining square holes through pure molybdenum. Electrical discharge machines are well suited for working the exotic alloys.

material of any hardness, as long as it is a conductor of electricity, can be readily discharge machined.

(3) Extremely fine surface finishes and extremely close tolerances can be obtained, with the first dependent upon the time that can economically be expended upon a part, and the second dependent upon final tool or electrode dimensions.

Miller expanded upon these later advantages. "In obtaining a very fine surface finish, very weak sparks must be used so that a minimum of metal is removed by each spark. This extends the machining time required. With some parts, it may be more economical to discharge machine the surface to a certain point and then finish by hand polishing. But on parts which cannot be hand polished, and which require a very high surface finish, discharge machining can do the job.

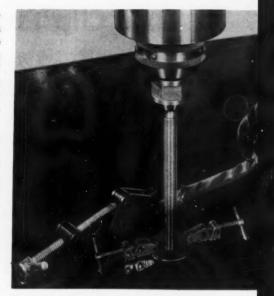
"When very close dimensions are required, the expendability of the tool or electrode must be the deciding factor. The final tool used in the operation must not have suffered any previous erosion, or the amount of erosion must be well within tolerance requirements. Thus, in a precision internal threading job, several tools may be used in roughing the threads and then more tools used as the degree of final tolerance is approached. Dimensions of the final tool must fall well within the required tolerance."

Miller pointed out that it is not always necessary to erode away all metal removed in a machining operation. Thus, in tap removal, or in drilling a hole, a hollow electrode may be used. This in effect permits discharge machining a "slug" of metal from the hole area, with spark erosion limited to removal of metal around the "slug" and in conformance with the hole outline.

In the years that they have specialized in discharge machining, the L. C. Miller Company has tackled and accomplished far too many jobs to list here. But most of this work centers around some type of cavity formation, or work in the cavity after it has been formed. Precision small hole drilling has also been accomplished, along with internal thread cutting.

"One important operation has been the machining of odd-shaped orifices in servo valves," Miller says. "Formerly, these orifices were machined by conventional methods in the side of the valve segment and then the segments were assembled together by brazing or some other mechanical method. With the electrical discharge machine, the orifices can be machined in a solid valve block.

"We have used our discharge machines for such diverse operations as making coining dies for bolt headers, machining snap-ring and O-ring grooves deep within a cavity, and for cross-porting with odd-shaped ports between two deep holes drilled in a solid block of material. Because of the hardness of the material involved, tool cavities of all types are a natural for the electrical discharge machine. Odd-shaped holes in all types of materials, and oddly shaped inter-



Drilling and tapping holes in titanium wafers in one operation. Hollow electrode machines slug from disc, then the threaded portion enters the hole and machines the threads while the electrode rotates at the proper pitch.

nal threads such as the broken threads used in a sliding rifle breech, fall in the same category.

"Many of our customers and many visitors to the L. C. Miller Company ask us to compare electrical discharge machining with other more conventional metal removal techniques. This tells us immediately that they know nothing at all about the process. Electrical discharge machining, properly employed, is not a replacement process. It is a new process, specifically intended to accomplish jobs that cannot be practically accomplished in any other way. Generally speaking, if a job can be done in any other manner, it is not a job for the electrical discharge machine!"

Zee Clip Producing Die

Unit completes part with one press stroke.

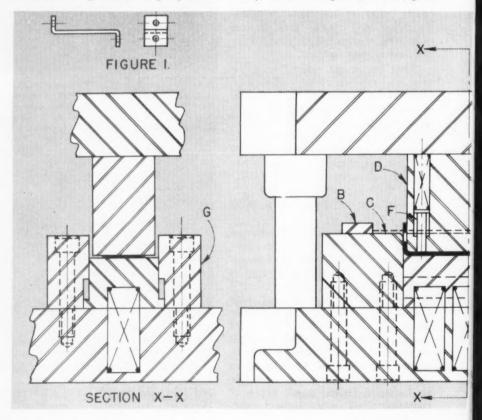
By ROGER ISETTS

Illustrated in Fig. 1 of the accompanying drawing is a zee clip made from 0.050-inch strip aluminum which was originally made in three operations. It was pierced and

cut off first and then completed with two hits on a press brake using a vee die.

Increased production of this part and a desire to reduce manufactur-

Part shown in Fig. 1 of drawing is produced in one press stroke using die shown in Fig. 2.

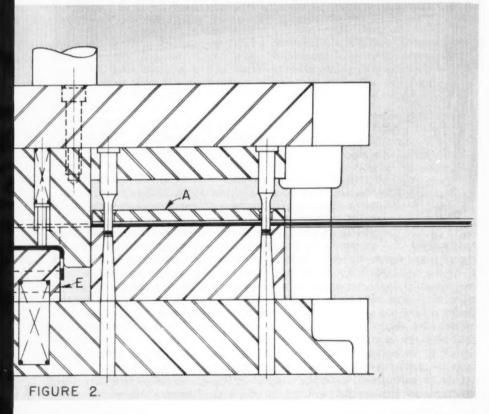


ing costs made it necessary to revise the tooling. Shown in Fig. 2 of the drawing is a die designed to make this part by combining all three operations. Each press stroke produces a finished piece with no scrap loss.

The stock is fed through a channel and the two holes are pierced. The strip is shed from the piercing punches by means of a positive stripper, A. The stock is then advanced to a solid stop, B, which is fastened to the top of form block, C. As the press ram descends, combination cutoff and form punch, D,

parts the stock and continues down, bottoming the part on spring loaded pressure pad, E. The two small spring loaded pins, F, serve the dual purpose of stripping the completed part off the punch, and, because they are slightly ahead of the cutoff, they prevent the stock from jumping. Two keeper blocks, G, confine the pressure pad and limit its upward travel.

The die is run on an open back inclinable press which permits the completed parts to fall clear by gravity into a container which is located at the back of the press.



December, 1961

Let's Discuss Numerical



Control

Fourth of a vital new series.

By K. M. GETTELMAN Associate Editor, Modern Machine Shop

One of the important considerations in the operation of numerically controlled machine tools is programming. Although the formalization of a program on perforated tape, magnetic tape, or tabulating cards is relatively new, the concept is as old as manufacturing itself. When man first

used a crude tool to produce a hand hewn war club, programming became a necessary step in the manufacturing process. His concept of how he was going to accomplish anything was probably very vague and subject to changes and improvisions as he went along, but there had to be a germ of an idea as to what steps were necessary to produce his simple artifacts. Today a tool operator may still in some circumstances vary and improvise as he goes along but with the advent of a machine tool directed and controlled by a programmed control unit, the requirement of pre-manufacturing formalization of all machining steps has reached a new high level of sophistication in what we have come to know as a program. This article, fourth in the numerical control series, investigates the creation of programs for continuous path type numerically controlled machine tools.

The time honored maxim "necessity is the mother of invention" was graphically illustrated in 1952 when Numerical Control became a working reality in the form of a continuous path contouring and sculptoring type machine tool. Aircraft design had reached the stage where single piece complicated configurations were required and some practical method of machining them was a necessity. Tracing or Kellering would not hold the required tolerances demanded by the aircraft designers. A two percent actual weight above the theoretical or design figure is probably quite insignificant in most instances but in an aircraft it can be the critical difference in fuel capacity, performance, or load capacity than can be a life and death matter. Just the development of the patterns which were traced had become a formidable task in itself. The design trends were moving toward such complexity that even those wallowing in the trough of taxpayer supported treasury funds were becoming concerned.

And so it was that numerical control was conceived, nurtured, and delivered in its most sophisticated form which certainly runs contrary to most of the experiences of mankind. The newly born infant immediately required an equally capable nursemaid in programming and the vitamin pill of a high capacity computer and master program to give the new creation a lusty growth in effectiveness.

The infant has now come of age and spawned the much simpler off spring in the Point To Point numerically controlled machine tool

which in terms of numbers has surpassed the continuous path elder. The Continuous Path classification has developed several personality characteristics which have defied fixed standardization. Although perforated tape has become the more prevalent control unit input media, on an overall basis, magnetic tape and tabulating card control systems continue to enter the market since they possess certain advantages. Even the perforated tape controlled machines come in two different varieties: those using the Binary Coded Decimal system of perforations and those using the Straight Binary (see page 152, October 1961 issue of MODERN MACHINE SHOP). Program development is by no means confined to a computer. Under many conditions a manually developed program may be the most practical.

Programming methods may vary but principles do not. A numerically controlled machine tool is a very obedient servant which will faithfully follow without question instructions that have been given to it within its capacity, but it cannot in any sense of the word think or improvise. In certain instances improvisions may be made by the machine operator if a clear necessity quickly arises. Such things as feed rates and cutter diameter compensations may be made by the machine operator at the machine if it is equipped with these controls. But the basic principle remains in that the programmer has to visualize and program every motion or function and put it into acceptable form before the machine tool is ever approached. The vital element of

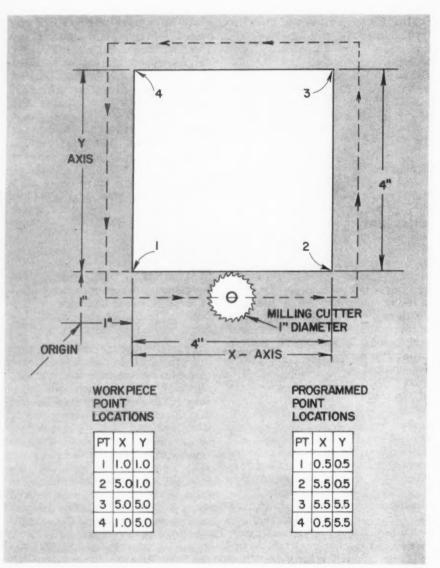


Fig. 1—This example of profile milling around a 4 x 4-inch piece of stock with a one inch diameter milling cutter shows how the programmer must allow for cutter offset. Since the programmed points are followed by the center point of the cutter and the

actual profile is made by the cutting edge, a one half inch compensation in programming has been made to allow for cutter radius. In some instances roughing and finishing passes are made with same program by using two different size cutters or cutter compensator.

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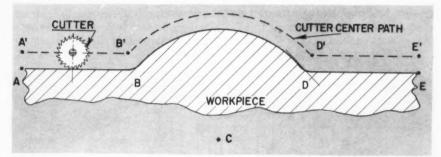


Fig. 2—In programming the above profiled configuration for a control system that has a circle interpolator the programmer will direct the cutter from point A to B. An appropriate code indicating that an arc is coming next will engage the circle interpolator. Upon receiving the tangent points B and D and the center point C and the direction of cutter travel (clockwise or counter clock-

wise), the circle interpolator will direct the cutting tool in a series of minimum pulse straight lines which will very closely approximate the arc. From D to E requires one block of perforated tape to describe this straight line. Unless the control system has a cutter offset compensator the programmer will actually program points A', B', C, D', and E' to profile this particular configuration.

human intelligence and judgment in the programmer bridges the gap between the engineering drawing and the machine tool whether a program is made manually or with the aid of a computer for either Point To Point or Continuous Path machine tools. Computer people have long had the saying "Put garbage in and you will get garbage out." N/C users have discovered that a garbage program put in might result in an output of pulverized tools or a sliced table.

Continuous path programming not only requires the determination of the best sequence of machining operations by the programmer but at some point the decision has to be made as to the best method of developing the program. Fortunately there are some pretty well defined guide posts that take much of the speculation out of this task. For instance if the machined configuration will be composed of all straight

lines, or simple curved surfaces, there is a very good possibility that manual program development will be the most practical from both time and cost considerations. If, however, the machining operations involve the production of complex shapes, the assist of a computer may be the most practical method of program development.

Before we become impaled on the horns of the proponents of two schools of programming, manual versus computer assist, we will point out one very basic fact: Any program on perforated tape or tabulating cards can be made manually. Notice that we said "can" and not "should" or some other emphatic term. Conversely any program whether perforated tape, magnetic tape or tabulating cards can be made with the assist of a computer. Obviously in certain areas either approach is impractical in terms of either cost or time. If forced to make

"Point to Point programs are done manually . . ."

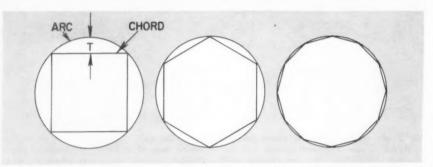


Fig. 3—Configurations obtained from continuous path machining are the result of a series of straight line or parabolic spans. The degree to which curved surfaces correspond to their design depends on how many lines or spans are used. In the above example illustrating the straight line 'principle it can be seen that four equal chords in a circle describe a square. Six make a hexagon, and as the number increases the lines themselves

come closer to a perfect circle, which is nothing more than an infinite number of lines end to end forming a closed plane equidistant from center. Number of lines used is determined by maximum tolerance—indicated by line T in the left circle—allowed between the design of the curved section, and the actual chord programmed. As the tolerance becomes smaller the number of required lines grows proportionately greater.

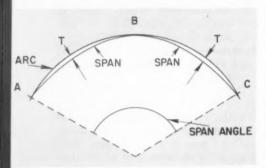


Fig. 4—The program development of curved surfaces for a parabolic span type control unit requires enough spans to stay within an acceptable tolerance. If, for example, the tolerance indicated by T is 0.001 inch, spans covering approximately 30 degrees are sufficient in a ten inch diameter circle or arc. As the diameter decreases spans covering wider angles are sufficient. Greater diameters require spans covering a smaller angle to effectively maintain the same tolerance.

a statement that covers the majority of programming activity we would say at this time that in general Point to Point programs are done manually with a few floating into the computer realm, and Continuous Path programs are divided with the tilt of the scales going toward some kind of computer assist. You can, however, get very persuasive arguments that a computer is the best approach to most Point to Point or that a computer need not be considered at all.

Assuming that a Continuous Path program is to be made manually, the programmer will follow the same principles and steps as he would with Point to Point. The engineering drawing is studied, a manuscript is written, and a clerk prepares a program tape or deck of tabulating

cards that are checked and verified. One of the principal tasks facing the programmer will be that of allowing for proper cutter offset. The programmed coordinate points, as in Point to Point, are the locations of the center of the cutting tool but the final machined configuration is of

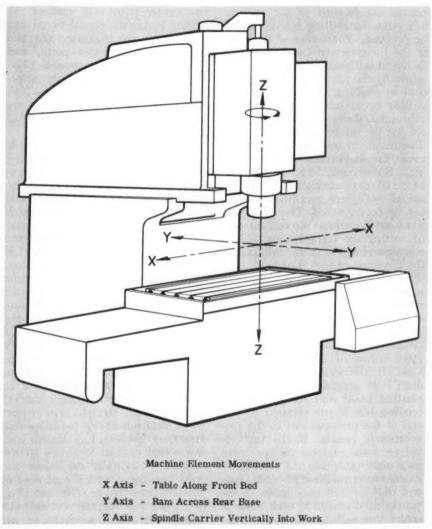


Fig. 5—Diagrammatic sketch of a continuous path machine, showing the axis elements. By combining the movements of the several

axes, various configurations can be quickly and easily machined. (Diagram courtesy The Cincinnati Milling Machine Company.)

"All continuous path machining is actually accomplished by working in a series of straight lines or parabolic spans."

course the product of the cutting tool edge. In drilling a hole this is no problem. The center of the hole is the programmed location of the drill and the hole diameter is determined by the size of the drill. When contour milling, the path of the milling cutter center point and the contoured shape of the workpiece are not the same. (See Fig. 1 for an illustration of how an allowance is made for the necessary cutter offset.) Some control units feature a cutter offset compensator so that the actual workpiece coordinate points can be programmed. The offset adjustment is made at the control unit by setting the compensator dial to correspond to the cutter radius and the direction of tool travel.

The programming of straight lines is not difficult. The X, Y, and Z coordinates for the beginning and ending points of each line may be stated with absolute or incremental positions (see page 133, November 1961 issue of MODERN MA-CHINE SHOP). The usual procedure is to program the cutter at a starting point and then each succeeding line is run straight off the end of the previous one to the new coordinate points. If the line involves motion along two or three axes simultaneously the axes drive mechanisms are directed by the control unit so that they move in the proper relationship to each other to make the called for straight line.

Many Continuous Path control systems have circle interpolators which when given the radius length and center point will control the cutting tool in the complete circular path. If an arc is desired the two tangent points, center point, and radius will be programmed (Fig. 2). Circles or arcs may be interpolated on a combination of the XY, XZ, or YZ axes. A circle or arc involving all three axes requires full

programming.

All continuous path machining is actually accomplished by working in a series of straight lines or parabolic spans. Control systems of the straight line type are digital and move a cutting tool by pulses which vield a specific distance of movement for each pulse. Although the pulse length may vary, one that is commonly used is 0.0002 inch. Thus on those machines with a two tenths movement, the circle interpolator will deliver enough straight line movements of this length to describe the programmed circle. Longer straight lines may be individually programmed and the machining of any curved surface is done by moving in enough straight lines to approximate the designed curve. The number of straight lines required is determined by the allowable tolerance between the design and the actual part as it comes off the machine. Naturally the closer the tolerance the greater the number of straight lines that are required (Fig. 3). Programs for any curved surface, other than a circle or arc limited to two axes, require a block of tape with coordinate locations for each straight line in the program.

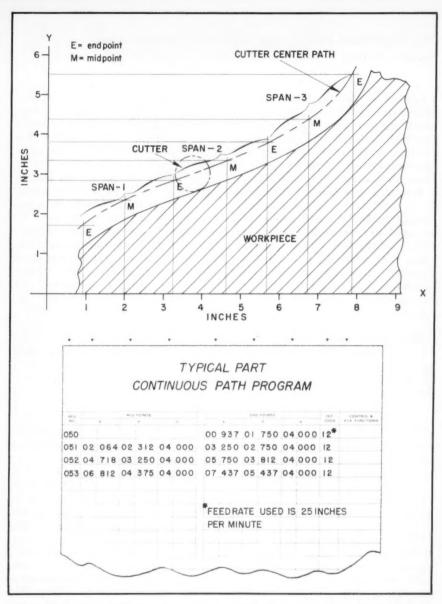


Fig. 6—Engineering drawing and program manuscript for simple continuous path profiling operation. The program is written for a control unit with a parabolic interpolator.

The beginning, mid, and end point of each of the three spans is programmed. The end point of span one is the beginning of span two. (Courtesy Cincinnati Milling Machine Co.)

". . . some part such as wing spars and fuselage skins require 50,000 or more coordinate points . . ."

Control systems with parabolic interpolators are analog in concept which means that there are no specific pulses of movement. Changes in direction of travel are accomplished with smooth curved lines which actually are portions of a geometric parabola. If the shape to be machined is not a parabola, enough parabolic spans end to end are used to approximate the design curve within the allowable tolerances. For example, if a ten inch diameter circle has a 0.001 inch allowable plus or minus tolerance in radius length, parabolic spans of approximately 30 degrees each, or about 12 would have to be programmed to form the circle. Each span has three programmed points—the two ends and a midpoint. The end of the first span, however, forms the beginning of the second and, as in the use of straight lines, each span is run off the end of the preceding one. Parabolic spans of any length can be defined with only the three necessary points and they can be programmed on any combination of two or three axes. The analog curve generator is built into the control system and interpolates from the three points. Since an infinite variety of parabolas can be drawn through three points, the curve generator will automatically pick out the one whose axis is parallel to one of the machine axes. Note that the span in all probability is not a complete parabola but only a portion of one (Fig. 4).

Program development for the

continuous machining of configurations other than straight lines, circles, or arcs for a digital control unit creates a situation where the consideration of a computer as a programming assist becomes worthwhile. Many of the design shapes (particularly in the aircraft industry where performance takes a top priority precedence) can only be described by complex mathematical formulas. It is not unusual for some parts such as wing spars and fuselage skins to require 50,000 or more coordinate points connected by straight lines to adequately describe the shape within an acceptable tolerance. Each line requires a block of program tape to adequately direct the machine tool cutter paths to machine within tolerance. Since proper allowance has to be made for cutter offset, it becomes readily apparent that a high speed computer making the myriad of mundane computations is the most practical method of program development.

If the tolerance is tight and a parabolic span control unit is used, the number of required spans probably will not be as great as the necessary number of straight lines in a given situation but even here a computer can often be the most advantageous method of choosing the optimum number and location of the spans to stay within the

tolerance figure.

Next month's article in this series will discuss the role of the computer and the master programs.



Namco DBS Vers-O-Tool gives... 50 times more pieces per grind

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When Stevens Manufacturing Company, Lexington, Ohio equipped a Brown & Sharpe No. 2 automatic with a NAMCO ¾ DBS Vers-O-Tool, the increased threading efficiency was astonishing. On the part shown, pieces-per-grind soared from an average of 1000 to 50,000; scrappage dropped 90%; production increased by 2½ times; tolerance trouble became a thing of the past. Stevens finds such performance typical for the DBS. A non-revolving threading tool, it's designed specifically for B & S automatics; has an exclusive automatic opening and closing mechanism for unmatched precision in cutting close-to-shoulder threads. Available capacities are shown below. Thousands of manufacturers use NAMCO threading tools to slash threading costs and improve thread quality. Our 44 page bulletin DT-60 will give you all the details. Get in touch. We'll be happy to send you a copy.

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*DBS %	No.O-OG-2 No. 2	3/4 34	% %	.071	.012	56 56	16 11

*Chasers and blocks interchangeable with ½ * DR and ½ * DS die.

†Chasers and blocks interchangeable with ½ * DR and ½ * DS die.

†And corresponding BSA sizes. Larger capacity Vers-O-Tools for B & S
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Aluminum expansion tube for Stevens Type H adjustable thermostat. Thread specifications: class—2; pitch—56,

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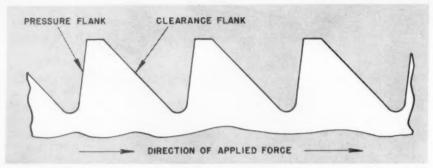


Fig. 1—The buttress thread, such as shown in this sketch, dates back as early as 1888.

Cutting 0 to 45-Degree Buttress Threads

Article describes thread form's history, usage and fundamentals.

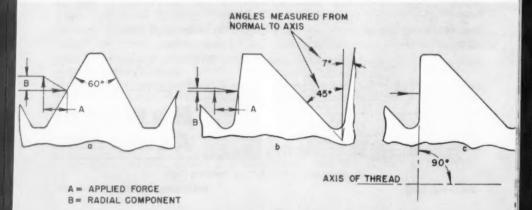
By D. E. YOUTZ Die Head Engineer

The buttress thread (Fig. 1) dates back as early as 1888 when a description appeared in the Journal of the Franklin Institute. This

form with its saw tooth profile is for uni-directional forces, disposing them in such a way that the radial component (Fig. 2) is as small as possible. For this reason it is considered excellent for tubular prod-

¹Screw Thread Standards for Federal Services H28-1957, Part III.

Fig. 2—This thread form, with its saw tooth profile, is for uni-directional forces.



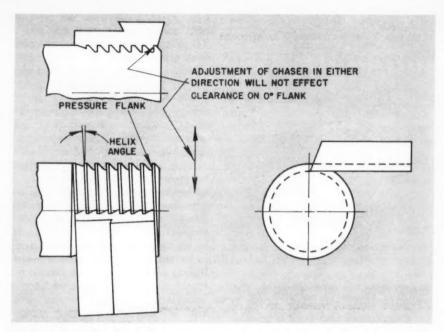


Fig. 3—Because little clearance between chaser and work is possible, finish is a problem.

ucts, when greater than average forces will be encountered and the need for reduced bursting tendencies caused by conventional flank angles must be met at threaded connections. Its use has not been limited to tubular products, however, but has found application on such items as jackscrews, ordnance, and so on, and in some cases also, where a buttress thread is of no benefit whatever.

Very little was done with it immediately after its conception, but eventually more and more designers became intrigued with this unorthodox form and a wide trail of unsymmetry appeared. This situation is improving, however, and instead of pressure flank angles (Fig. 1) rang-

ing from 0 to 15 degrees and clearance flanks from 30 to 55 degrees, the latest edition of Screw Thread Standards for Federal Services H28-1957, Part III recommends a buttress form with flank angles 7 and 45 degrees (Fig. 2b) and the crests truncated on the internal and external threads to result in a basic depth of .6 pitch.

A 0 degree pressure flank would be the obvious optimum because there would be no radial component (Fig. 2c), but difficulties in quantity manufacture have dictated a minimum of 7 degrees.

In production, an economical tool to produce this thread is the tangential self-opening die head. The buttress is more difficult to cut than a

". . . proper clearance between chaser cutting edge and work is necessary for success."

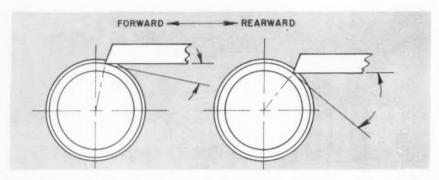


Fig. 4—Clearance between the chaser cutting edge and the work is controlled by moving the chaser tangentially—forward for less clearance and rearward for more clearance.

thread with greater flank angles. Because little clearance (Fig. 3) between chaser and work is possible on the low angle pressure flank, finish is a problem; and when the pressure flank is to the rear (Fig. 3) on the work, there is a tendency to pull the die head forward faster than the correct lead. Therefore, the problem in which we are primarily interested relative to cutting but-

Fig. 5—If the chaser is moved too far forward, the cutting edge moves beyond the point of tangency and rubbing will result.

tress is that of sufficient clearance on the pressure flank.

In the production of any thread, proper clearance between chaser cutting edge and work is one of the necessities for success. It is controlled by moving the chaser tangentially-forward for less clearance and back for more clearance (Fig. 4). If the chaser is moved too far forward, the cutting edge moves beyond the point of tangency and rubbing will result (Fig. 5); if moved too far in the opposite direction. out-of-roundness and chatter will occur, although the furthest position possible toward the rear without chatter, and so on, is the most desirable condition.

All threads can have the clearance between chaser cutting edge and work increased, or decreased by tangential chaser adjustment—with varying potential. The possibility increases as the flank angle nears a position parallel to the work cen-

ter line and decreases as it nears a position normal to center line, reaching zero at normal (Fig. 3). If the flank was nomal to the work axis and the chaser was adjusted tangentially while laying at the proper helix angle, nothing would occur in the way of a change in clearance. For these reasons the 7 degree pressure flank has been considered as minimum for practical production.

Lately it has been necessary to cut 0 to 45 degree buttress threads; that is, with the pressure flank normal to the axis. The only way clearance can be changed on the 0 degree flank is by changing the angle of chaser contact. Instead of laying at the correct helix angle of the thread it must be moved around to something less in order that only the cutting edge be touching. It was found that the best position was approximately such that there was 45 minutes' clearance (Fig. 6).

The line of contact on the 45 degree or clearance flank then takes a new position back of the cutting

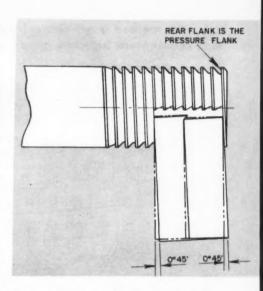


Fig. 6—The best position was approximately such that there was 45 minutes' clearance.

edge (Fig. 7). It becomes necessary to move the cutting edge as far back of center line as possible in the "more clearance" direction, without creating chatter, so as to clear the area where rubbing would occur.

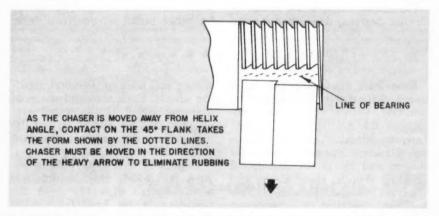


Fig. 7—Line of contact on the 45 degree flank takes a new position back of cutting edge.

"... the method is not conducive to long chaser wear between grinds ..."

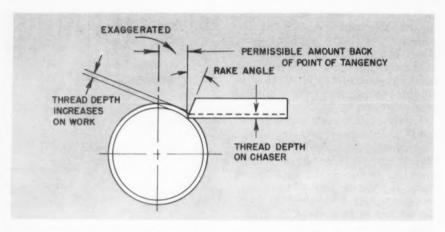


Fig. 8—This rearward position creates an abnormality in thread form by cutting too deep.

This rearward position creates an abnormality in thread form by cutting too deep (Fig. 8). For this reason, the form on the chaser must be made shallow a corresponding amount.

The above changes are made in varying degrees, depending on the

rigidity of the equipment used. Even though it is possible to cut this thread, the method is not conducive to long chaser wear between grinds, nor ease of setup. It should not be thought of as a form to be used indiscriminately as a replacement for other buttress requirements.

* * * * * * * * * * * * *

American Standard for Diamond Grinding Wheels. The Grinding Wheel Institute announces the availability of a new American Standard entitled "American Standard Specifications for Shapes and Sizes of Diamond Grinding Wheels, Hand Hones and Mounted Wheels, B74.3-1961." This document contains thirty-seven pages of information on standard

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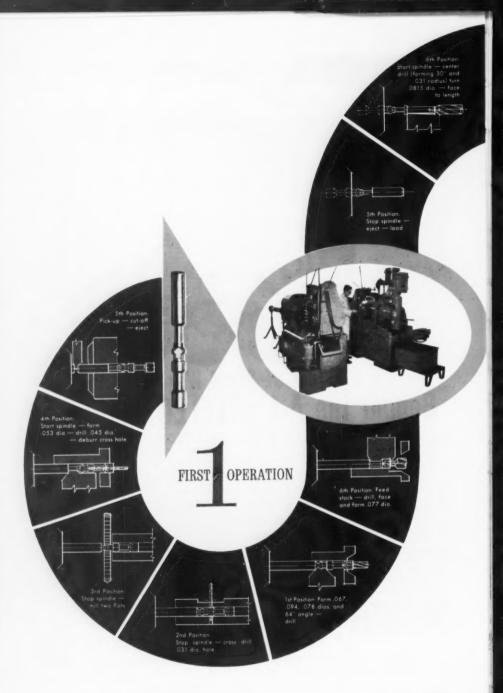


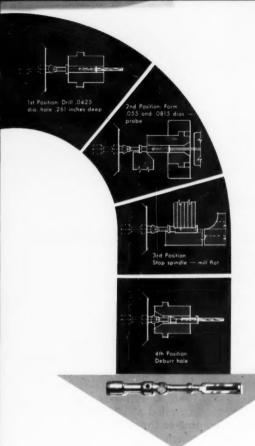
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Low Cost Numerically Controlled Drill Hits Market

Taking the plunge to prove that numerically controlled machine tools are here to stay and that they offer unique and tangible savings in money, time, setups, and other areas which can be directly translated into a monetary figure, Pratt & Whitney Co., West Hartford, Conn., recently unveiled an N/C drill called the Tape-O-Matic. According to the company, Tape-O-Matic achieves a breakthrough not only in electronic reliability of the control system but more importantly a breakthrough into a selling price "far below anything ever dreamed of previously." To achieve this price the machine is being mass produced. A view of a Tape-O-Matic is shown in Fig. 1.

In commenting on this development by an American builder, Paul N. Stanton, Vice President of Marketing, declared, "There has been criticism of America's Machine Tool Industry and the comment made that our industry cannot compete effectively with foreign builders. We believe that the concept incorporated in the Tape-O-Matic Drill will enable our company to compete successfully against any company, anywhere in the world."

The control unit manufactured by Pratt & Whitney uses the EIA standard one inch perforated tape with



"Spindle speeds cover two infinitely variable ranges . . ."

BCD coding as the input media. The base price includes control of the X and Y axes with actuation of the drilling cycle by the tape, an available feature at additional cost. The control unit also features a full floating zero and the ability to read minus figures which aids in simplifying program development. A closed loop feedback design assures positive positioning.

Features of the drill itself include a 30-inch by 20-inch table with a 20-inch travel along the X axis and 15 inches along the Y. There are four table T-slots 9/16 of an inch in width spaced five inches apart parallel to the X axis. Quill travel

is a maximum of 61/2 inches and the head has a vertical adjustment of 14 inches. Distances of the spindle nose to the table surface can vary from four to 241/2 inches. The spindle bore will accommodate a No. 3 Morse taper, Total recommended floor space for both the machine and the control unit leaving two feet all around for operator access is 115 by 175 inches. Spindle speeds cover two infinitely variable ranges of 300 to 2000 r.p.m. and 150 to 1000 r.p.m. Three table and carriage jogging speeds of 300, 8 and 0.5 inches per minute are standard. The table and carriage rapid traverse speeds are 300 inches per minute. The spin-

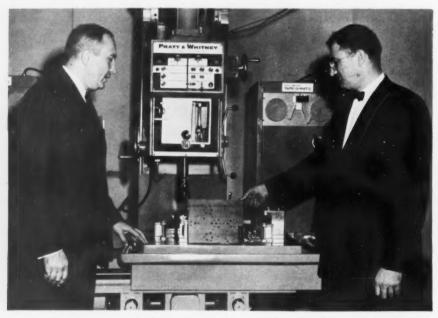
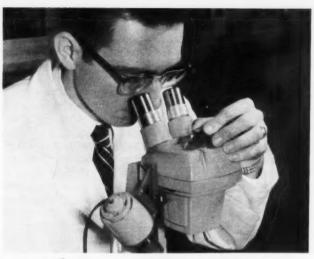


Fig. 3 — Mr. Paul Stanton (left), Vice President of Marketing, and Mr. Joe Sala (right), Production Engineer, study an orifice plate which was produced on the Tape-O-Matic drill.

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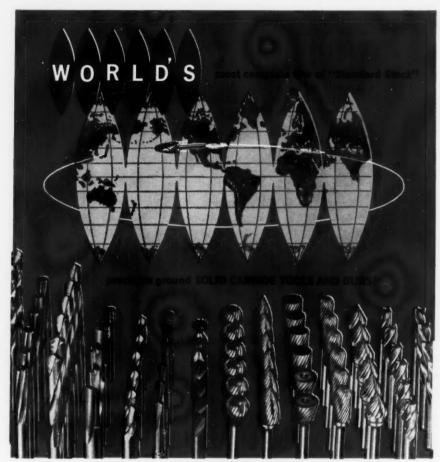
dle drive motor is 1½ h.p. with a 3 h.p. available on an optional basis. Accuracies claimed for the new machine are plus or minus half a thousandth on positioning and repeatability with squareness of the X and Y axes held true to a tenth.

Several machine tool marketing features have been established with a 90-day money back offer if the machine does not cut the customer's drilling costs, a 1 percent cash discount for payment within 10 days, and 5 year warranty against defective parts and workmanship.

Pratt & Whitney officials are quick to point out that this N/C drill will not remove metal any faster than the same type conventional machine once the cutting tool is in contact with the workpiece. Tremendous savings can be and were realized by P & W in using the first prototype models to manufacture succeeding machines through the elimination of many jigs and fixtures, more rapidly getting from one position to the next on the workpiece, and the ability to do a series of operations on the one machine rather than several which, of course, eliminated both lead and setup time. A typical example of production savings can be seen in a motor base plate, as shown in Fig. 2, which is normally produced at the rate of 15 pieces per year in three lots of five each. The plate requires 12 holes of which ten are drilled, countersunk, and tapped. The other two are drilled and counterbored. Formerly all 12 holes were spotted on a jig borer and then finished on a radial drill. Each time a

lot was produced, 0.65 hour was spent setting up the jig borer and 0.62 for the radial drill. Piece cycle time was 0.26 hour on the jig borer and 0.36 on the radial drill. By using the Tape-O-Matic 0.80 hour was spent preparing the tape which will last indefinitely and all operations are then done on the machine at 0.33 hour per piece after a 0.65 hour setup time. The former method required a floor to floor time of 0.87 hour per piece after prorating the setup time and the new method requires only 0.51 hour per piece after prorating the tape preparation over one year when it actually could be used indefinitely. This represents a 58.6 percent reduction in floor to floor time and the release of the jig borer for other work.

Another time and money saving example is illustrated in Fig. 3 where an orifice plate requiring the drilling of 51 holes may be seen located on the machine table. The program tape for this workpiece required only two hours' time of a part programmer and one hour of a typist's time to punch it. Setup time is eight minutes using nesting blocks and clamps and floor-to-floor production time is 121/2 minutes. A center drill and two standard drills are shown at the lower right-hand corner of the plate. If a conventional drill press were used for this part, a \$500.00 jig requiring three weeks' lead time would be necessary. The jig would require warehousing and would incur taxation each year. An estimated floor-to-floor time of 36 minutes per piece would be required employing conventional methods.





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MODERN MACHINE SHOP

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MORE





Setup time and tooling costs have been reduced at Hughes Aircraft Company's El Segundo Division, where Airborne Systems Group engineers made ingenious adaptations of cartridge boring with slotted spindle plates and "erector set" fixtures to provide recoverable tooling in short run manufacture.

Cartridge Boring Provides "Recoverable Tooling" in Small Lot Manufacture

In the complex world of aircraft-missile systems manufacture, production runs of 50 to 100 units are commonplace. The manufacturer's chief problems are getting the work on and off the machines fast and keeping contract implementation costs down.

At the El Segundo Division of Hughes Aircraft Company, Airborne Systems Group engineers faced the problem of about 100 different parts going through the line for turning, milling, drilling and boring. The product is a map display case machined from aluminum precision sand castings, from plate stock or, in some cases, from solid. The map display cases are part of an optical assembly in airborne fire control systems.

In its approach to the problem, Hughes engineers used five No. 122 and one No. 222 Heald Double End Precision Bore-Matics equipped with hydraulic cross slides,

THROUGH



MODERNIZATION

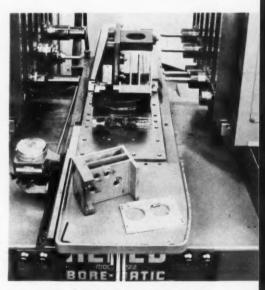
rotary index fixtures and cartridge type boring spindles. The cartridge spindles solved the problem of sufficient spindle capacity to bore interrelated holes. Vertical adjustment of the cartridge spindles through slotted plates was devised. The vertical slots give unlimited settings in the vertical plane.

A six-position turret stop with screws for adjustability accurately positions the cross slide. This, in conjunction with a high precision rotary indexing fixture on top of the cross slide, permits boring multiple surfaces on a workpiece in one setup and thereby combines versatility with the high degree of repeatability needed. A Vernac is utilized in some instances to accurately establish or check cross slide index positions.

With the Heald cartridge boring heads, hole centers $\frac{3}{4}$ inch apart became possible. Speeds and feeds are variable but relatively unimportant because the map display cases are only a maximum of $\frac{1}{4}$ inch thick. Control of hydraulics, coolant and room temperatures maintains the environmental control for

stabilization of parts before, during and after machining.

On the thin map display castings, Hughes can now bore two to three



Setup on Heald 222 Bore-Matic shows cartridge boring beads, slotted spindle plates and fixture, with parts to be machined in the foreground. Vertical slots give unlimited settings in vertical plane which can be repeated easily if the setup is torn down.

more production . . .

sides, plus milling and fly cutting. The versatility of the setup is indicated by the fact that the vertical slides eliminate the need for changing plates when used in combination with the cross slide. Boring speeds are completely variable to suit hole conditions.

To set up a job, a master having the general configuration of the part to be machined and with corresponding holes accurately positioned is placed in the workholding fixture. An electronic indicator attached to the boring spindle zeroes in these holes by adjusting the vertical position of the boring head and the screw stop in the barrel on the cross slide.

One of the setups is performing turning, milling, drilling and boring operations. With the saving in heads, riser blocks, plates as well as other tooling, Hughes can now go from one job to another with very low additional tooling costs. For more data circle 1 on Postpaid Card

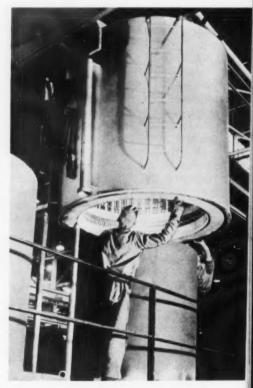
* modern machine shop *

Nitriding Furnace Increases Quality Control

Complete nitriding facilities are an important factor in a new quality control program at The American Tool Works Company. Integrated with all other manufacturing procedures as a part of the "assembly line" at American Tool's Cincinnati plant, this nitriding facility gives this recently formed department complete control of

every step in the production of lathes, radial drills and special machines. This facility enables American Tool to produce the only radial drills with nitrided boring mill type spindle units and the only tracer lathes with nitrided Nitralloy slides as standard equipment.

Because of the lack of stresses and distortion caused by quenching, and the extreme hardness and wear resistance of nitrided Nitralloy, American Tool Works adopted the



Nitriding furnace is lowered over ammonia gas chamber loaded with radial drill spindles and tracer lathe cross slides. Parts are finished within 0.003 inch before nitriding to provide for best possible case hardening results.

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MODERN MACHINE SHOP

121

more production . . .

material for radial drill spindles and sleeves as a means of improving drilling operations. Because, unlike other metals, there is no affinity between two surfaces of this material, tolerances of spindles to sleeves are kept to 0.0002 inch without danger of scoring or pick-up. Coupled with a patented Lo-hung drive, fully ground gears and other rugged construction features, this nitrided Nitralloy spindle and sleeve makes the American radial drill a boring machine as well.

On the American 45 degree tracer lathe, the cross slide is nitrided to

approximately 105 to 110 scleroscope surface hardness, reducing wear to a minimum and retaining accuracies which allow such exact duplication that template-to-work-piece accuracies of plus or minus 0.0002 inch have, in many cases, made final grinding unnecessary.

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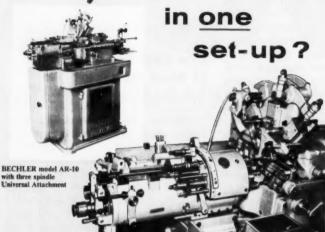
Machining Truck Shackle Pins

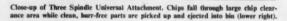
With the machine shown herewith, developed by Kingsbury Machine Tool Corp., Keene, N. H., nine units drill, countersink and tap

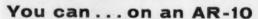


Machine tool designed for drilling, countersinking and tapping truck shackle pins.

Can You machine this part.....









efficiency. The pick-up arm supports the workpiece and separates it from the chips.

Valve Needle for fuel feed system

-1.755" long. Material—commercial bronze .375" diameter. Square end is machined by a milling head mounted on a spindle of the Uni-

This part is completed in less than a minute-without need for costly secondary operations!

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The basic model AR-10 has a barstock capacity of $\beta_0^{\rm eff}$ and five cross tools for single point contour turning. In machining this costly valve needle the five cross tools are

Attachment, headstock spindle brake and headstock

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used for turning, thread rolling and generating the radius and taners.

spindle indexing device.

The Universal Attachment with three spindles performs the drilling, tapping and milling operations. The headstock spindle brake and indexing device are used in milling the square end. A cam shaft accelerator increases

BECHLER Swiss Automatics are available with barstock capacities up to 11/4"-turning length to 9".



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MODERN MACHINE SHOP

123

1.755"

more production . . .

truck shackle pins at a gross rate of 590 parts per hour. A 24-inch index table holds nine work fixtures with manual clamping and unclamping.

The operator places the work in a vee in the fixture and against a stop in back. A pivoted arm clamps the work. The fixture is actuated from the clamping handle through a cam. By using different fixed vees and adjusting the stop, the fixtures accommodate parts of different diameters and lengths, up to 1.50 inches in diameter and 5.44 inches long.

Seven units are available to drill a long axial hole in steps, depending on the depth required for each size of shackle pin. The last horizontal units taps the hole, and a vertical unit drills a cross hole. For more data circle 3 on Postpaid Card

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Low Cost Welding of Blast Furnace Cooling System Boxes

Hibben and Company, Chicago, steel plate fabricator and erector, needed no elaborate training or fancy fixtures to double production volume and lower production costs—just one of Lincoln Electric Company's Innershield Squirt Welders and a two hour practice period. This new semi-



Welding a blast furnace cooling system box using a Lincoln Innershield Squirt Welder.



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MODERN MACHINE SHOP

125

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mechanized vapor shielded method of arc welding increased production of 229 blast furnace cooling system boxes from 5½ to over 11 completed assemblies daily. Work crew and production facilities were the same. Only the method of welding was changed. This simplified approach to semi-automatic welding combines the speed and economy of mechanization with the flexibility of manual stick electrode arc welding.

Key to the new vapor shielded method is the tubular self-shielding mild steel electrode wire, fed mechanically through a 24 ounce welding gun. This electrode is continuously supplied from a 50-pound reel mounted in a remote console. Weld stopping and starting are actuated by a trigger on the welding gun, welding current being regulated by the wire feed speed.

In this application, involving

deposition of 19½ feet of 5/16-inch laps and fillets on the 5 pretacked, ½-inch thick plate members of the cooling box, current averages 500 amp. d.c. positive at 32 arc volts. Travel speed is in the range of 18 i.p.m. Fit up is not critical.

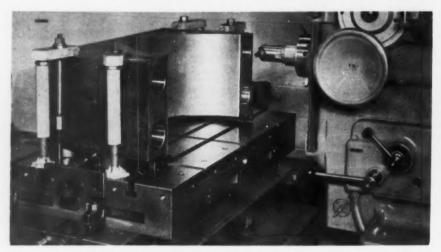
The tubular electrode wire contains materials for shielding, fluxing, and deoxidizing, eliminating the need for external fluxes or shielding gas. Slag coverage of the welding bead is easily chipped or wire brushed.

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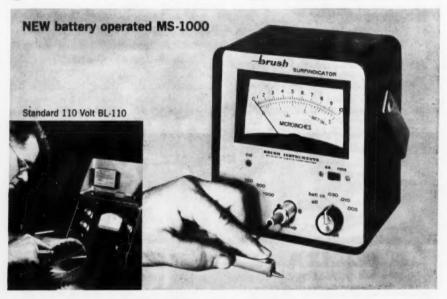
Stub Boring with Titanium Carbide Tools

The accompanying illustration shows a setup for stub boring on a production basis with titanium carbide cutting tools. Surface finishes obtained are in the range of 22 to



Setup for stub boring steel connecting rods with titanium carbide cutting tools.

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37TH AND PERKINS



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more production . . .

25 r.m.s. The bores, each 15 inches deep and 3 1/16 inches in diameter, are machined in a large, medium carbon, heat treated, forged steel connecting rod component for a producer of marine diesel engines.

According to engineers at De-Vlieg Machine Co., Royal Oak, Mich., who tooled up the job, the four pilot bolt holes of the part, which is 31 inches wide, 11½ inches high and 15 inches deep, are rough and finish bored in 1 hour and 22 minutes. This does not include drilling which was done as a prior operation.

To do the work, the part is positioned on a Type E index table, mounted on a 3-inch spindle Jigmil. With this setup, the bolt holes are bored half-way through from one



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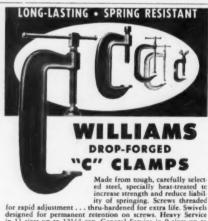
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side, then the whole 26 x 40-inch table holding the work is indexed 180 degrees for boring from the opposite side. About 0.150 inch of stock is removed during boring operations. Conventional steel grade carbide cutting tools are used in roughing at cutting speeds of 420 r.p.m., at a feed of 0.0075 inch. Bores are then chamfered at a speed of 90 r.p.m., followed by finish boring with titanium carbide cutting tools at speeds of 940 r.p.m. at 0.0045-inch feed, Adjustable Microbore units enable the titanium carbide cutting tools to be set to remove stock of 0.003 inch on a side. Holes are so accurately spaced that they serve as alignment points when connecting rods are assembled. They must match holes of three other members machined independently. For more data circle 5 on Postpaid Card





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IDEAS FROM READERS

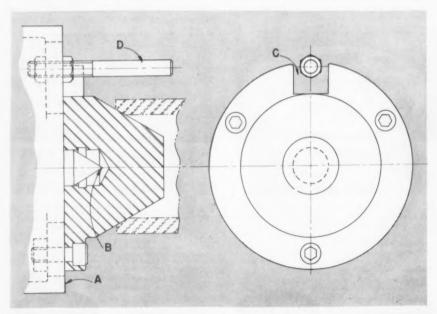


Rigid Bull Center

By ROGER ISETTS

When running lathe work between centers in conjunction with a faceplate, a job will often come along requiring a larger than normal center. Very few shops carry a selection of such centers as standard equipment.

Shown in the accompanying sketch is a simple method of making a very sturdy larger-than-ordinary center that can be kept around the machine for those special jobs. It is made to firmly bolt directly to the faceplate, A, itself, making it un-



Sketch of rigid, larger-than-ordinary center for lathe work involving use of faceplate.

necessary to keep knocking the regular center, B, in and out of the spindle.

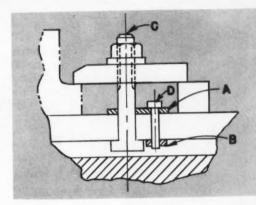
A round section of steel is turned down to a 30-degree angle as shown. A center hole is ground to a slip fit over the regular center, B. Three holes are drilled and counterbored in the flange for bolting the center to the faceplate, A. A clearance slot, C, is milled in the outer flange for the driver, D.

modern machine shop *

Anchoring T-Slot Bolts

By M. W. LOFTUS

When repetitive work is clamped with general use clamps and T-bolts, time and effort can be saved if the bolt does not shift



Skech shows method of anchoring T-slot bolt.

when the clamp is loosened, and then have to be positioned again. The bolt can be anchored in the table by using two pieces of rectangular bar stock, as shown at A

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ideas from readers . . .

and B in the accompanying sketch. The piece, A, is drilled for the T-bolt, C, and has a hole for a clamp screw, D. The piece, B, fitting in the T-slot and acting as a nut, is tapped for the clamp screw, D.

* modern machine shop *

Springs and Metal Tubing Make Chuck Jaw Spacers

By H. J. GERBER

Often when gripping work in a lathe chuck it is desired to grip the work a slight distance away from the faces of the chuck jaws, so as to prevent the cutting tool

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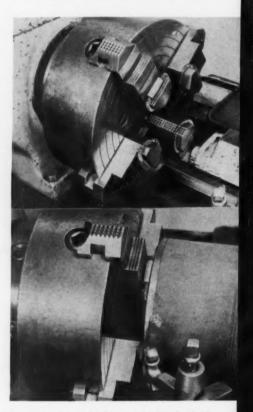
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132 MODERN MACHINE SHOP

from hitting the jaws as it passes over the end of the work. We often make use of the method shown herewith to hold such work a uniform distance outward on each chuck jaw.

A short piece of steel tubing is held in place against each jaw face by a light duty extension spring which has been run through the tube and looped over the desired step on the jaw. We keep a number of sizes of these tubes, along with an assortment of springs, on hand.

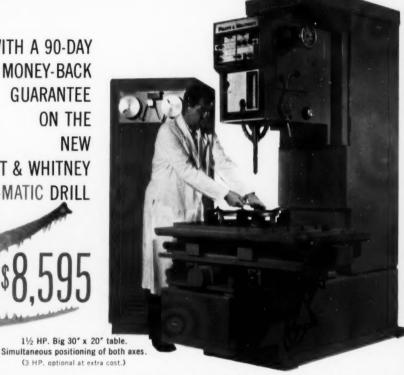


Springs and metal tubing make handy chuck jaw spacers, as shown in these views.

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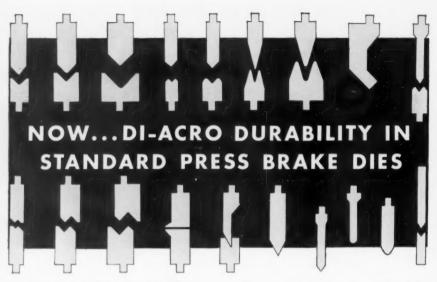
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1961

Article Index

A subject listing of articles published in MODERN MACHINE SHOP during the past year.

		-		-	
А	22	E	M	ь	LY

Airless	Spraying	of	Metal	Bonding	Adhesive	 . 140

AUTOMATION

Fabricating Compressor Housings at Whirlpool Jan.,	108
Special Cylinder-Producing Machine	131
Pneumatic Recorder Assures Quality Jig Boring Apr.,	158
Miller Speeds Duplication	144
Motor Shell Manufacturing Automated	148
Automatic Drilling of Small Diameter HolesAug.	., 96
Maintaining Dimensions Relative to a Floating Face . Sept.,	138
Deburring Tube EndsOct.,	154

RENDING

DEIADIIAO					
The Million	Dollar Bend			 Mar.,	126
Press Brake	Type Die for	Arbor	Press	 Apr.,	162
How to Box	d Tubing			Cani	120

BORING

Automobile Parts Bored Four at a Time	153
Producing Pipeline ValvesFeb.,	122
Machine Presets Tooling for Boring Operation Feb.,	
Boring Differential Housings from Three Directions Feb.,	154
Tracing Simplifies Machining Jobs	140
Combination Setup Produces Automotive Part Mar.,	141
Versatile Setup Increases Pillow-Block Production May,	145
Setup Reduces Cost of Machining TurretJune,	144
Special Boring Heads Increase Cylinder Production July,	114
Unique Machine Reduces Axle Boring CostsJuly,	122
Three-Way Machine for Cylinder Machining Aug.,	120
Spring Loaded Bushing Controls Depth of Bore Sept.,	
Machining Thin-Walled Parts	122
Cartridge Boring Provides "Recoverable Tooling" Dec.,	118
Stub Boring with Titanium Carbide ToolsDec.,	

BRAZING

BRAZIIIO	
Material Change Cuts Cost of Turbocharger Jan.,	154
Brazed Cutting Tool Cleaning	154
Special Tooling Extends Use of Induction Heaters July,	100
Brazing Process Maintains Close Tolerances July	120



March, Page 100



July, Page 100



January, Page 108

BROACHING

Problem	Solved	in	Broaching	Breech	Ring	Body	 .Jan.,	149
Broachin	g-Tool	ing	and Pra	ctice			 .June,	122

BURNISHING

Roller Burnishing Contributes to Automotive Safety . . Sept., 151

CARBIDE TOOLING

Special Carbide Grade Cuts Machining CostsJan.,	150
Machining Railroad Car WheelsFeb.,	156
Machining Steering Cylinders	142
Gear Blank Production Increased	160
Throw-Away Inserts for Armor Plate Turning May,	148
Production Milling Aluminum Blocks Sept.,	150
Special Milling Cutter Solves Rough-Milling Problem Sept.,	158
Industry Standards for Cemented Carbide Products Sept.,	164
Stub Boring with Titanium Carbide Tools Dec.,	126

CHEMICAL MACHINING

Electro-Chemical Machining of Refractory Alloys June, 102

CLAMPING

Hose Clamps Helpful in Grinding Ends of Pins Feb.,	162
What's There to Know About Demagnetization? Apr.,	132
Quick Clamp Simplifies Fixture DesignJune,	152
Tie Bar Increases Usefulness of Parallel Clamps Sept.,	163
Anchoring T-Slot Bolts	131
Springs and Metal Tubing Make Chuck Jaw Spacers. Dec.,	132

CLEANING

Cleaning Turbocharger Parts	Mar.,	112
Brazed Cutting Tool Cleaning	May.	154

COOLANTS

High Speed Machining	of	Non-Ferrous	Parts	 May,	124
Machining Missile Parts	3			 June,	118
Concentrated Coolant	Aid	B Drilling		 Aug.	122

DEBURRING

Automatic	Deburring	Tube	End	Oct.,	15	4
-----------	-----------	------	-----	-------	----	---

DIE DESIGN

Design for a Compound Die	.Jan.,	128
Roller Bearing Cage Multiple Piercing Die	Feb.,	134
Electrical Discharge Machining Cuts Die Costs	Feb.,	144
Press Brake Dies	Mar.,	103
Record-Size Die	Mar.,	107
Design for a Hub-Producing Die	Mar.,	124
Press Brake Type Die for Arbor Press	Apr.,	162
Simple Die Forms Beaded Channel	May,	134
Die Forms Feather-Edged Cup Washer	June.	132



February, Page 130



November, Page 122

Sectional Type Punching Die July, 132 Lathe Chuck Aids Die Grinding Aug., 123 Die Forms Special Channels Oct., 142 Design for a Sub-Press Perforating Die Nov., 143 Machinable Carbide Dies Nov., 153 Zee Clip Producing Die Dec., 90	
DRAWING Fabricating Compressor Housings at WhirlpoolJan., 108	1
Producing Aluminum Alloy Pistons Mar., 100 Numerically Controlled Drill for Structural Parts Mar., 136 Deep Hole Drilling Missile Parts May, 121 Special Drilling Setup for Window Frames May, 152 U-Shaped Layout Machining Center June, 123 Drilling Close Tolerance Holes June, 136 Reduction Drive for Electric Drill June, 154 Automatic Drilling of Deep Holes Aug., 96 Machining Cast Iron Compressor Heads Aug., 118 Concentrated Coolant Aids Drilling Aug., 122 Let's Discuss Numerical Control Oct., 144 Submerged Drilling Improves Hole Finish Oct., 168 Turret Drill Reduces Costs Nov., 152 Low Cost Numerically Control Drill Hits Market Dec., 110 Machining Truck Shackle Pins Dec., 122	
ELECTRICAL DISCHARGE MACHINING Electrical Discharge Machining Cuts Die Costs Feb., 144 A Look at Electrical Discharge Machining Dec., 82	
EMPLOYEE TRAINING Let's Discuss Numerical Control in Simple Language Apr., 120 Getting Ahead in Industry Apr., 130 A Wage Incentive Need Not Be a Give-Away Apr., 144 High Speed Machining of Non-Ferrous Parts May, 122	
EXPOSITIONS Idea Center for Industry West Mar., 132 ASTME Tool Show in Print May, 184 The 1961 Detroit Metal Show Oct., 128	
FASTENING Airless Spraying of Bonding Adhesive	
FIXTURES Foolproof That Jig or Fixture	
FORMING The Electroshaping Process Jan., 122 Giant Floturn Machine Demonstrated Feb., 148 Portable Radiant Heater Simplifies Forming Work Apr., 116 Automatic Press Bank June, 142 How to Bend Tubing Sept., 130 Cases Produced by Ardeform Process Oct., 124 Improving Quality on Motor Switch Parts Oct., 156	



June, Page 102



April, Page 144



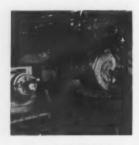
May, Page 144



August, Page 106



May, Page 126



July, Page 112

MODERN MACHINE SHOP

136

	_	

ONOTINO	
Ball Plunger Aids Close Tolerance GagingJan.,	157
Precision Measurement and Gaging Techniques Apr.,	142
Toolmaker's Buttons Establish Accurate Angles Apr.,	163
Method for Checking Lathe Bed Wear	164
Machining Missile PartsJune,	118
Gaging System Solves Manufacturing Problem June,	148
Tool Indicator Guards Against Dull Cutting Tools July,	118
Telescoping Gage Made from Worn Plug Gage Aug.,	124
Production Chacking of Gage and Spline Leads Oct	160

GRINDING

on-Critical Surface Grinding Simplified	.Jan.,	14
ose Clamps Helpful in Grinding Ends of Pins	Feb.,	163
aired Grinding Wheels Solve Breakdown Problem	Mar.,	140
merican Standard for Grinding Wheels	Apr.,	119
recision Quills Reduce Manufacturing Costs	June,	14
inish Machining Missile Nose Cones		
othe Chuck Aids Die Grinding		
rinding Stresses		
roduction Line Grinding of Piston Rods		
tandard System Solves Grinding Dust Problem		
rinding Filmstrip		

HEAT TREATING

Straightening Shafts	146
Radiant Heater Simplifies Hot Forming WorkApr.,	
Special Tooling Extends Use of Induction Heaters July,	100
Four-in-One Heat Treatment	156
Nitriding Furnace Increases Quality ControlDec.,	120

INCENTIVE SYSTEMS

A	Wage	Incentive	Need !	Not :	Be o	Give-Away	 144

INSPECTION

III ECITOR		
Dye Penetrant Flaw Location Movie	Jan.,	115
Method for Checking Lathe Bed Wear	Apr.,	164
Production Checking of Gear and Spline Leads	Oct.,	160

HC

1103			
Foolproof That Jig or	Fixture	Mar.,	128
Universal Jig for Tool	Work	July,	130
Drill lig for Threaded	Ports	Nov	164

MACHINE DESIGN

Tandem Mill Doubles Cold Rolling CapacityFeb.,	landem	Mill Doubles C	old Rolling	Capacity	Feb.,	19
--	--------	----------------	-------------	----------	-------	----

MACHINE MAINTENANCE

How Thorough	Is Your	V-Belt	Maintenance?	Nov	146

MATERIALS

THE STREET SERVICES		
Working the Exotic Alloys	.Jan.,	116
Material Change Cuts Cost of Turbocharger Assembly	.Jan.,	154
Revised Data on Machining Aluminum		

December, 1961

Producing Aluminum Alloy Pistons Mar., 10 Faster Machining Stainless May, 14 Extruding Brazing Wire to 1/32 Inch in Diameter July, 12 New Steel Provides Longer Tool Life Aug., 11 High-Strength Steels for the Missile Industry Nov., 15 Machinable Carbide Dies Nov., 15	0 4 4 1
MATERIALS HANDLING Hogging—A Job Shop Specialty	0
METALLIZING Metallizing Corrosion-Proofs Plane Parts	0
METALLURGY Working the Exotic Alloys Jan., 110 The Electroshaping Process Jan., 121 Producing Aluminum Alloy Pistons Mar., 100 Hard-Surfacing Increases Camshaft Service Life Apr., 150 Faster Machining Stainless May, 140 Electro-Chemical Machining of Refractory Alloys June, 160 Relieving Stresses by the Torch Method June, 150 Mechanical Hands Manipulate Radioactive Elements Aug., 110 Production Line Hardening of Piston Rods Sept., 150 Hard Facing Large Aluminum Roll Nov., 120	2 0 6 0 2 3 6 4
MILLING Standard Drill Press Speeds Milling of Meter Housings Jan., 146 Tracer Machining Beryllium Feb., 130 Treatise on Milling and Milling Machines Feb., 146 Routing Non-Ferrous Aircraft Parts Mar., 104 Miller Speeds Duplication May, 146 Vertical Mill Used in Repairing Compressors May, 146 Completing a Part in One Operation Aug., 91 Developing Machine Tool Instructions Aug., 106 Machining Cast Iron Compressor Heads Aug., 116 Portable Tools Solve Machining Problem Sept., 156 Production Milling Aluminum Blocks Special Milling Cutter Solves Rough-Milling Problem Sept., 156 Interview with N/C Job Shop Manager Oct., 114 Let's Discuss Numerical Control Oct., 144 Vertical Mill Aids Gasket Die Production Nov., 156	02444466116688660
NUMERICAL CONTROL Developing Machine Tool Instructions Aug., 100 Let's Discuss Numerical Control Sept., 116 Interview with Job Shop Manager Oct., 114 Let's Discuss Numerical Control Oct., 146 Let's Discuss Numerical Control Nov., 126 Let's Discuss Numerical Control Dec., 92 Low Cost Numerically Control Drill Hits Market Dec., 116	6
PEENING Bearingizing Increases Life of Helicoptor Components Jan. 148 Steel Ball Burnishing and Sizing of Holes	3



January, Page 134



October, Page 114



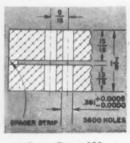
September, Page 124



August, Page 94



October, Page 134



June, Page 136

PI	AN	IT	IA	YC	SU	T

Miniature Fabricati	on S	hop	Speeds	Parts	Production	Jan.,	134
Machining Missile	Parts					June,	118
U-Shaped Layout .						June,	123
Plug-In Bus Duct In	ncrec	ises	Shop V	ersati	lity	.Sept.,	142

PLANT MANAGEMENT		
As I See Your Supervisory Problems	Jan.,	105
Miniature Fabrication Shop Speeds Parts Production	Jan.,	134
Machine Shop Operations and Setups	Jan.,	140
As I See Your Supervisory Problems		
Are Vision Problems Hampering Your Production?		
Supervisory Problems		
Welder Manufacturer Reverses Import Trend	. Mar.,	108
Expanding Working Capital in Metalworking	. Mar.,	116
Supervisory Problems	.Apr.,	112
A Wage Incentive Need Not Be a Give-Away		
Supervisory Problems	. May,	112
Supervisory Problems		
What Is a Numerical Control Programmer?	June,	110
Accounting for Time	.June,	124
Supervisory Problems	July,	80
Are You Looking for Proof?	July,	84
Principles of Manufacturing and Processes	July,	105
Supervisory Problems		
Pre-Planning Speeds Job Assignment Work	Aug.,	100
Supervisory Problems	Sept.,	112
Let's Discuss Numerical Control	Sept.,	116
Supervisory Problems		
Interview with N/C Job Shop Manager		
Interview on Leasing Machine Tools	Nov.,	114

POLISHING

Non-Critical	Surface	Grinding	Simplified	Icm.	144	ı

PRESSING

Impact Extruding Cans from Aluminum DiscsJan.,	114
Portable Radiant Heater Simplifies Forming Work Apr.,	116
Press Brake Die for Arbor Press Apr.,	162
What Constitutes a Good Press Safety Program? May,	126
Automatic Press BankJune,	142
Hydraulic Press Brake Forms Roof Deck	156

PROFILING

Tracer Machining BerylliumFeb.,	130
Tracing Simplifies Machining Jobs	140
Electro-Chemical Machining of Refractory Alloys June,	102
Tracer Machining and Explosive FormingJune,	150
Are You Looking for Proof?July,	85
Giant Tracer Machining InstallationJuly,	113
Interview with N/C Job Shop ManagerOct.,	114
Let's Discuss Numerical ControlOct.,	144

PUNCHING

Cartianal To	vne Punching	Dia	July.	122
Sectional L	vpe Funching	1310		4.3%

QUALITY CONTROL
Pneumatic Recorder Assures Quality in Jig Boring Apr., 19 Clean Room for Quality Control July, Machining Small Gears Oct., 13 Nitriding Furnace Increases Quality Control Dec., 12
REAMING Combination Setup Simplifies Part Production
ROUTING Routing Non-Ferrous Aircraft Parts
SAFETY METHODS AND SYSTEMS Are Vision Problems Hampering Your Production? Feb., 12 What Constitutes a Good Safety Program May, 12 Machining Magnesium Race Car Wheels Aug., 9 Mechanical Hands Manipulate Fuel Elements Aug., 11
SAND BLASTING Brazed Cutting Tool Cleaning
SAWING Aluminum Plate Cutting Machine
SCREW MACHINING Cam and Tool Design Jan., 12 Screw Machine Products Report Jan., 12: Automatic Screw Machine Film Feb., 13: U-Shaped Layout Machining Center June, 12: Completing a Part in One Operation Aug., 8: Machining Small Gears Oct., 13:
TAPPING Tapping Machine Modified to Process Blender Base July, 122 Machining Truck Shackle Pins
TESTING Chilling Machine Tests Automotive PartsOct., 158
TOOL DESIGN Heavy Duty Cam Clutch Screw Driver

Tool for Removing BushingsOct., 166

Rigid Bull Center Dec., 130



March, Page 136



November, Page 146



April, Page 116



September, Page 142



December, Page 82



February, Page 148

		A RESIDENCE		-
TOOL	AA A		1 A N	16 1-

Tightening	Loose	Pulleys				 ×					*		Nov.,	1	63

TURNING

Special Carbide Grade Cuts Machining CostsJan.,	150
Lathe Tooling for Oil GrooveJan.,	156
Tracer Machining BerylliumFeb.,	
Giant Floturn Machine DemonstratedFeb.,	148
Cutting-Off and Forming in One OperationFeb.,	160
Producing Aluminum Alloy Pistons	
Machining Large Gear Blanks	140
Machining Steering Cylinders	142
Gear Blank Production Increased	160
Method for Checking Lathe Bed WearApr.,	164
Hogging—A Job Shop Specialty	
Throw-Away Inserts for Armor Plate Turning May,	148
Setup Reduces Cost of Machining TurretJune,	144
Coordinated Development Shop Cuts Prototype Costs . July,	106
Liquid LatheJuly,	109
Giant Tracer Machining InstallationJuly,	113
Machining Race Car WheelsAug.,	94
Machining Thin-Walled Parts on Turret Lathe Nov.,	122
Self-Aligning Stop Aids Chucking	162
Cutting O to 45 Dogges Buttones Through	100

WELDING	
Producing Pipeline ValvesFeb.,	116
High Speed Welding of Center SillsFeb.,	140
Welder Manufacturer Reverses Import Trend Mar.,	108
Welding Data Book	115
Motor Shell Manufacturing Automated May,	148
Electron Beam Welding Facilitates Vessel Production . Sept.,	124
Improved Design Reduces Welding Costs Sept.,	162
Cases Produced by Ardeform ProcessOct.,	124
Improving Weld Quality on Motor Switch Parts Oct.,	156

GENERAL INTEREST		
The Electroshaping Process	.Jan.,	122
Anti-Friction Bearing Study	.Feb.,	136
Machinability Report	. Mar.,	111
Let's Discuss Numerical Control in Simple Language	Apr.,	120
A Wage Incentive Need Not Be a Give-Away	.Apr.,	144
What Constitutes A Good Safety Program	. May,	126
ASTME Tool Show in Print	. May,	184
What's the Job of a Numerical Control Programmer? .	June,	110
Handbook of Fluid Dynamics	.June,	135
Principles of Manufacturing and Processes	.July,	105
Compressed Air and Gas Handbook	July,	108
The 1961 Detroit Metal Show	.Oct.,	128
Chilling Machine Tests Automotive Parts	Oct.,	158
Dust Collecting System Solves Grinding Problem	Oct.,	162
Interview on Leasing Machine Tools	Nov.,	114
Let's Discuss Numerical Control	Nov.,	126
Lathe Run-Off Bubble	Nov.,	140
Gear Classification Manual	Nov.,	144
Low Cost Welding of Blast Furnace Boyes	Dec	124



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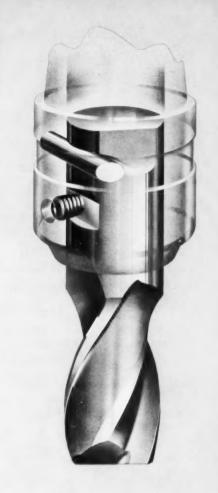


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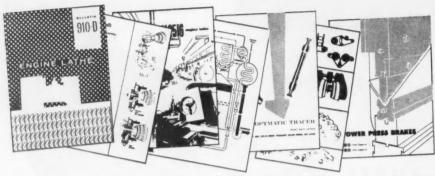
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Synthetic Fluids and Lubricants

Dow Chemical Co., Midland, Mich. Technical literature describes the characteristics and advantages of the Ambilfioline of synthetic fluids and lubricants. The series includes 23 different products, including both soluble and water-soluble materials.

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Press Brake

Dreis & Krump Mfg. Co., 7418 South Loomis Blvd., Chicago 36, Ill. Bulletin T 135-61 contains standard features and specifications of the Model 135 Chicago Press Brake.

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Combination Conduit Supports

Erico Products, Inc., 2070 East 61st Place, Cleveland 3, Ohio. Catalog illustrates and describes a combination beam clamp and conduit hanger.

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Electro-Hydraulic Tracer Mills

Famco Machine Co., Kenosha, Wis. 6-page catalog gives an insight into the many job functions performed on electrohydraulic tracer mills. The system and operations are graphically illustrated. For more data circle 9 on Postpaid Card

Circuit Board Routers and Drills

M. A. Ford Mfg. Co., 1545 Rockingham Rd., Davenport, Iowa. Bulletin No. 109 describes the characteristics, performance, sizes and prices of the carbide diamond-grind routers in addition to the solid carbide drills with the new circuit board point.

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Marking Machine

Geo. T. Schmidt, Inc., 1806 West Belle Plaine, Chicago 13, Ill. Brochure, in color, describes the GTS Nameplate Detail Press, Prices are also included. For more data circle 11 on Postpaid Card

Balancing Machines

Gisholt Machine Co., Madison 10, Wis. Form 1165-C illustrates and describes the Type "S" Dynamic (two plane) and Static (single plane) Balancing Machines. Revised specifications and an explanation of the standard Type "S" features are included.

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Saw Blades

Hakansson Industries, Inc., 9932 South Torrence Ave., Chicago 17, Ill. Brochure, in color, illustrates and describes band saw blades and hand hack-saw blades. Specifications are also included.

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Box Furnaces

Lindberg Engineering Co., 2450 West Hubbard St., Chicago 12, Ill. Bulletin 1094 details the capabilities of two boxtype furnaces, Type GB6-6104-A and Type GB-55. Specifications are also included.

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Cylinders

Tomkins-Johnson Co., Jackson, Mich. Bulletin No. SQ-61, in color, comprises 48-pages of technical dimensions and engineering data on the entire T-J Squair Head Cylinder line for its 1½ inch through 14 inch bore sizes.

FREE LITERATURE

nd Inside Back Cover for requesting free copies of literature listed below.

Drill Jig Bushings

Acme Industrial Co., 200 North Laflin, Chicago 7, Ill. Conversion chart is designed to expedite the ordering of drill jig bushings. Also included in the literature is a listing of A.S.A. standard symbol numbers. For more data circle 16 on Postpaid Card

Materials Handling Systems May-Fran Mfg. Co., 1720 Clarkstone Rd., Cleveland 12, Ohio. MF Bulletin 200 B. in color, describes and illustrates customized conveyors from prefabricated conveyor sections. Curved sections, concave and convex, can be supplied in 30, 45, 60, 75 and 90 degree bends to comply with individual needs. For more data circle 17 on Postpaid Card

Surface Measuring Instrument

Micrometrical Mfg. Co., 3621 South State Rd., Ann Arbor 7, Mich. 8-page, 2-color technical bulletin describes the Profilometer, a surface measuring instrument, and its conformity to the ASA Standard B46-1-1955. For more data circle 18 on Postpaid Card

Universal and Independent Chucks

Kalamazoo Industries, Inc., P. O. Box 2558, Kalamazoo, Mich. Folder illustrates and describes the Kalamazoo Universal and Independent Chucks. Price list is also included. For more data circle 19 on Postpaid Card

Tapping Unit

Procunier Safety Chuck Co., 12 South Clinton St., Chicago 6, Ill. Flyer describes the variable speed lead screw tapping unit in two models, Model No. VLS and Model No. 3-VLS.

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Drilling and Tapping Machine

Jackson-Fotsch Co., 7350 West Lawrence Ave., Chicago 31, Ill. Brochure, in color, illustrates and describes the Cleereman Series "A" Automatic Cycle Drilling and Tapping Machine. Dimensions and specifications are also included. For more data circle 21 on Postpaid Card

Keyway Selection

Davis Keyseater Co., 3111 Winton Rd., South, Rochester 23, N. Y. A card is available for engineers to select the proper size keyway for various jobs. The card can either be hung over drawing boards or placed under the glass of

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Printing Machines

Acromark Company, 9 Morrell St., Elizabeth. N. J. An illustrated article describes printing equipment for industry covering both decorative and parts marking applications. The illustrations show machines in action and typical products. For more data circle 23 on Postpaid Card

Spring Coilers

Perkins Machine and Gear Co., Special Machinery Div., West Springfield, Mass. Brochure, in color, illustrates and describes precision spring coilers in 3 models including hand, power and variable speed models.

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Boring Bars

Vascoloy-Ramet Corp., 890 Market St., Waukegan, Ill. Catalog 6105, in color, illustrates and describes V-R Boring

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free literature . . .

Electronic Counter

Veeder-Root, Inc., Electronic Controls Div., 5 Maple St., Danvers, Mass. 4-page bulletin describes and illustrates a new electronic counter (Series 181709) for liquid measuring systems, to calibrate flow meters under test, featuring a builtin instantaneous gating device. Diagrams, dimensional drawings and photographs are also included.

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Hydraulic Filters

Vickers, Inc., Administrative & Engineering Center, Detroit 32, Mich. Bulletin 61-78, in color, illustrates and describes Tell-Tale Filters for suction line use in hydraulic systems.

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Sawing Machines

Wallace Supplies Mfg. Co., 1804 W. Cornelia Ave., Chicago 14, Ill, Catalog illustrates and describes "Cut Machining" with the No. 1500 Series Wallace Modular "Cut Machining" Units. Prices and specifications are also included. For more data circle 28 on Postpaid Card

Drill Heads

Zagar, Inc., 23898 Lakeland Blvd., Cleveland 23, Ohio. Brochure DH-9-61 illustrates and describes heads for drilling, reaming, tapping and boring. Charts, pictures and drawings for all necessary accessories for drilling and tapping further complete the presentation of application and use of Zagar Heads.

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Flat Lapping Service

Abrading Systems Co., 3636 West Oakton St., Skokie, Ill. Catalog 861 illustrates and describes facilities for flat machining screw machine parts, stampings, castings, sintered parts and ceramics.

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Stainless Steel

Armco Steel Corp., Product Information Service, Middletown, Ohio. Data folder P. O. 3861 entitled "How to Heat Treat Armco 17-4 PH Stainless Steel," in handy wall chart form, covers six specific heat treatments from Condition A (as received from the mill) H 900 and H 925 to H 1150. A section on procedures includes cleaning, types of furnaces, temperature control, time at temperature, heat-treating atmosphere, cooling and techniques for removing heat tint. For more data circle 31 on Postpaid Card

Specialized Production Facilities

Danly Machine Specialties, Inc., 2100 South Laramie Ave., Chicago 50, Ill. 12-page brochure describes Danly's welding, machining, assembly, engineering and other facilities.

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Lubricants

J. A. Postell, 936 West Peachtree St., N. W., Atlanta 9, Ga. Application chart simplifies proper selection of lubricants containing the ingredient molybdenum disulphide. The chart lists forms of application as dry powders, aerosol spray, greases, liquids and various bonded coatings.

For more data circle 33 on Postpaid Card

Safety Tread

Carborundum Co., Niagara Falls, N. Y. Folder describes a pressure sensitive safety tread product which comes in cleats or strips for stairways, ladders and fire escapes. It is also available in rolls up to 24 inches wide by 96 inches long.

For more data circle 34 on Postpaid Card

Carbide Tools

Atrax Company, 240 Day St., Newington 11, Conn. Brochure gives application information and prices on small, very small and miniature, precision ground solid carbide tools. Micro-drills in wire sizes No. 40 through No. 80, miniature end mills, stub routers, hole grinding burs, midget burs and micro-reamers are also listed in the brochure.

For more data circle 35 on Postpaid Card

Tape-Controlled Turret Drilling Machines

Burgmaster Corp., 15001 S. Figueroa St., Gardena, Calif. 16-page catalog covers Burgmaster 6 and 8 spindle tape-controlled turret drilling, tapping, milling and boring machines. Four basic models are illustrated and described, and the procedure for programming work and making tape is explained.

For more data circle 36 on Postpaid Card

Furnaces

Blue M Electric Co., 138th & Chatham St., Blue Island, Ill. Bulletin No. 1550 illustrates and describes both bench and floor models of the Stabil-Glow Box Type Furnaces. Information is also included on Blue M's Stabil-Glow Bench Type Muffle Furnaces, Stabil-Glow Industrial and Laboratory Floor Type Furnaces, bench and floor type Rad-O-Glow Globar Furnaces and Crucible or Pot Furnaces.

For more data circle 37 on Postpaid Card

Why Chicago Rivet Offers TWO METHODS for Clinching Semi-Tubular Rivets

It is part of a widening service based upon industry's recognition that an assembly held together by semi-tubular rivets has great inherent strength and is usually lowest in production cost.



The Chicago Rivet MOTORIZED AUTOMATIC RIVET SETTER produces a sharp, solid blow that immediately upsets the tubular section. This method is used on 95% of all applications involving metals or non-fragile materials.

The Chicago Rivet AIR-POWERED
RIVETER produces a cushioned,
shock-free clinch on a tubular rivet,
permitting riveting of fragile
and uneven materials. This
method has greatly widened the use
of semi-tubular rivets.



RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

FOR YOUR FILES



AIR-POWERED
RIVETING catalog
contains description
and specifications
of 8 single and
multiple riveters—
also rivet setters
designed for
automated
operation.

Chicago Rivet

& MACHINE CO.

963 So. 25th Ave., Bellwood, III. (Chicago Suburb) · Branch Factory: Tyrone, Pa.

Branch Factory: Tyrone, Pa.
For more data circle 401 on Postpaid Card

Why not let Chicago Rivet Fastening Engineers tell you which system is best for you. No obligation.

MOTORIZED

Line includes automatic single, multiple and automated setters.

AIR-POWERED

Line includes automatic single, multiple and automated setters.

free literature . . .

Boring Tools

Giddings & Lewis Machine Tool Co., Davis Div., Fond du Lac, Wis. 8-page Catalog D-560 describes the "L-type" micrometer-adjustable railroad car wheel boring tools. Specifications, prices and ordering instructions for the boring tools, parts, and SHSS, cast alloy and carbide cutters are described. Also provided are cutter grinding instructions and a cutter grinder attachment is described.

For more data circle 38 on Postpaid Card

Die Tryout Press

Alpha Press and Machine, Inc., 9281 Freeland, Detroit, Mich. Catalog, in color, describes the complete line of Alpha Standard Rotary Head Die Tryout Presses. Dimensions, specifications and drawings of the 50 to 300 ton capacity presses are given, including portable models.

For more data circle 39 on Postpaid Card

Electrical and Lubricating Devices

Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis. Catalog 61 covers a complete line of electrical and lubricat-

ing devices. Products are fully illustrated with photographs, and besides catalog numbers, such important engineering data as specifications and operating descriptions of automatic oilers, chain oilers, dispensers, single and multiple valves are supplied.

For more data circle 40 on Postpaid Card

Radii Finisher

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. Data Sheet 1026-61 describes and illustrates the Roto-Flo Model 1026 Radii Finisher, a new burnishing machine that strengthens parts at critical fillets by coldworking and compacting the surface.

For more data circle 41 on Postpaid Card

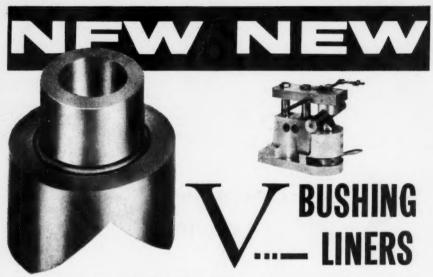
Forge Furnace

Johnson Gas Appliance Co., 571 E Avenue N. W., Cedar Rapids, Iowa. Flyer, in color, describes the Johnson No. 133 Forge Furnace. Specifications are also included.

For more data circle 42 on Postpaid Card



For more data circle 402 on Postpaid Card



To self center cylindrical, square or hex stock for drilling

V for victory over a previously ticklish drilling job . . . new hardened ground Acme Industrial V bushing liners clamp over cylindrical (round bars, tubing, etc.), square or hex stocks . . . instantly, automatically locate dead center. Layout, jig boring eliminated . . . just center punch, drill and ream hole! Acting as a liner for removable bushings, Acme's "V" assures precision centered drilling always.

Available in 2 sets of 3 V bushing liners to accommodate slip bushings with O.D.'s of 3/16", 5/16" and 1/2" in a range from No. 80 drill to 11/32" in A.S.A. or Acme standard sizes. Acme V bushing liners . . . a must for every tool box.

	USTRIAL COMPANY Laflin Street/Chicago 7, Illinois		
	Send me complete information on new V bushing liners Send me the complete Acme Industrial bushings catalog		
Name			
Firm			
Address			
City	ZoneState		

For more data circle 403 on Postpaid Card

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Machine Tool Leasing

DoAll Company, Des Plaines, Ill. 4-page brochure discusses the 5 principal advantages of the DoAll rental plan: (1) no capital expenditure is required, (2) profit producing equipment is available when needed, (3) established lines of credit are undisturbed, (4) profits pay for rentals and (5) the lease contract is handled locally.

For more data circle 43 on Postpaid Card

Air Cylinders

Rivett Lathe & Grinder, Inc., 18 Riverview Rd., Brighton, Boston 35, Mass. Manual No. 10 illustrates and describes the operation and application of air cylinders. Drawings and specifications are also included.

For more data circle 44 on Postpaid Card

Abrasive Belt Grinders

Hammond Machinery Builders, Inc., 1615 Douglas Ave., Kalamazoo, Mich. Catalog ABG-300 contains data on the Hammond Abrasive Belt Grinders and their wide application on grinding.

polishing, buffing and deburring operations such as internal, flexible belt, platen, contour and contact wheel. Specifications, photographs and cutaway drawings illustrate the construction features of each grinder.

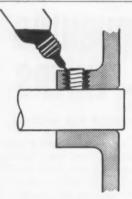
For more data circle 45 on Postpaid Card

Lifting Magnets

Stearns Magnetic Products, 635 South 28th St., Milwaukee 46, Wis. Bulletin No. 3022 lists over 50 styles and types of circular and rectangular lifting magnets. Detailed cutaway view of the magnets, capacity and dimensional charts are also included. For more data circle

46 on Postpaid Card
Carbide Turning

Tool Selection Wesson Corp.. 1220 Woodward Heights Blvd., Ferndale 20, Mich. Bulletin 7-61 evaluates factors in selecting throwon-end aways, insert holders or flat tools for turning with carbides. Line drawings and photographs are also included.



One drop of Loctite and a set screw stays put!

Loctite Sealant, "the Liquid Lock Washer," wicks between threaded surfaces...then hardens in the joint. Locking action extends over entire engaged area. Result: an end to costly breakdowns caused by vibration-loosened screws. Parts treated with Loctite are removed easily with ordinary tools.

Call your distributor, or write us for literature and free sample.



AMERICAN SEALANTS COMPANY

225 NORTH MOUNTAIN ROAD . HARTFORD 11, CONN.

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SEI				
"OHE PLUS" METHOD	SHORT RUN METHOD	PRODUCTION RUN METHOD	"WATCH BOG" SERVICE	And the second second second second
Applies when you need just a few pieces for proto-types or experiment. We hold all critical dimensions, yet avoid tooling charges.	More than "a few," but less than pro- duction quantities. Temporary tooling, simple dies and special presses keep costs down.	Applies when quan- tity, tolerance, size and contour factors justify our standard production tooling and/or nominal die charges.	A routine proce- dure. We re-evalu- ate repeat orders as to quantity and specs—then use the Method best for you.	
charges,				1/1
	70.00			
	A.			
	75			
7	76			
7	75			

STAMPED METAL PARTS

We have been producing Stamped Metal Parts at the Laminated Shim Company, not as a sideline, but as the mainstay of our business since 1913. That's important for you to know. It is just this kind of experience and specialization that provides you with an unmatched Service in Stampings as near as your phone.

With this Service you get top quality Stampings . . . (1) in any size, any shape, ranging from iny lock washers to electronic chassis to husky

rocker arms...(2) in any quantity, from a single prototype to a million or more...(3) all within accepted tolerances and finishes for the class of work involved...(4) at surprisingly low cost.

So... for better Stamped Metal Parts, faster and at low cost, call DAvis 5-2631 or send your prints for quotes directly to the ... LAMINATED SHIM COMPANY, INC., 3312 Union Street, Glenbrook, Conn.

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free literature . . .

Numerical Control

Friden, Inc., 97 Humboldt St., Rochester 2, N. Y. 32-page booklet presents educational data about machine toolnumerical control. The booklet defines the meaning of numerical control and explains the use of punched tape in machine tool applications. Where numerical control is used, programming tapes, standardizing punched tapes and standardizing programming are also included.

For more data circle 47 on Postpaid Card

Cylinder Lock Valves

Sarasota Precision Products, Inc., 5757 McIntosh Rd., Sarasota, Fla. Engineering data sheets have detailed information on the new Series 1600 Cylinder lock valves. Schematic drawings, typical circuit applications, approved JIC symbols and all pertinent dimensions are also included.

For more data circle 48 on Postpaid Card

Boring, Recessing and Threading Tools

Bokum Tool Co., Inc., 14775 Wildemere Ave., Detroit 38, Mich. General Condensed Catalog 6110 describes super highspeed steel, carbide-tipped and

solid tungsten carbide boring tools; permanent or non-adjustable toolholders; Bokumicro-Dial Boring Head; Rapidor roughing and cutoff tools; swing boring toolholders; Bokumatic recess toolholders and standard highspeed steel grooving tools.

For more data circle 49 on Postpaid Card

Solid Lubricants

Alpha - Molykote Corp., Stamford, Conn. Bulletin 132, in color, discusses the theory and use of solid lubricants. Actual applications describe how solid lubricants have solved difficult lubrication jobs. For more data circle 50 on Postpaid Card

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Steel Shelving
Standard Pressed
Steel Co., Columbia-Hallowell Div.,
Box 556, Jenkintown, Pa. Catalog,
Form 2791, contains assembly features, component parts and practical advantages of three basic types of Hallowell Steel
Shelving.

For more data circle 51 on Postpaid Card



The new Cleveland INSPECT-RON is especially adapted to inspection for roundness, concentricity and squareness measurement in the shop.

Measurement is made to a precise spindle mounted in the surface plate on top of the desk size console. Spindle accuracy is guaranteed radially and axially to .00005". The built-in polar coordinate recorder enables the operator to analyze the part measurements on a permanent visual chart.

Electronic gaging is provided by the use of the accepted Cleveland Indi-Ac which can easily be used for other gaging operations.

Cleveland Precision Instruments Include:

INDI-AC—Ultra-Precision Electronic Height Gage

MICRO-AC—Electronic Micro-Comparator PAR-AC—Electronic Production Gage

INDI-RON—Ultra-Precision Roundness, Squareness and Concentricity Gage INDI-AC Jr.—General purpose precision gage. Battery and AC operated.

Cleveland INSTRUMENT COMPANY

A SUBSIDIARY OF THE BENDIX CORPORATION

6220 East Schaaf Road . Cleveland 31, Ohio

For more data circle 406 on Postpaid Card

53-pound grip on 1/32" thin strip...

B&S chuck demonstrates holding power sufficient for 8 hp grinding machine load — by supporting its own weight on 1" x ½2" steel strip.

New Brown & Sharpe Micro-Mesh Chuck

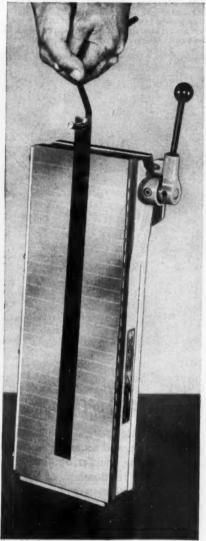
holds parts as thin as .001" for grinding!



Make big savings, grinding or machining small parts. Use the only magnetic chuck that grips work as thin as .001", tight enough for production cuts.

Close-spaced, barium-ferrite (ceramic-type) permanent magnets — no dead spots or weak zones — powerful, unbroken field, over the entire working surface.

Ask your B&S distributor for new Micro-Mesh Chucks! Brown & Sharpe Mfg. Co., Prov. 1, R. I.





PREGISION GENTER

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Carbide Products and Die Machinery

Firth Sterling, Inc., 3113 Forbes Ave., Pittsburgh 30, Pa. Catalog FDM-6 lists wire puller jaws and inserts; round wire, bar and tube drawing dies; square and hexagon shape drawing dies; mandrel nibs; rough cored and semi-finished reading die nibs; nail and tack tooling inserts; barbing laps, and die finishing machinery. Specifications are also included in the catalog.

For more data circle 52 on Postpaid Card



Accurate Bushing Co., 443 North Ave., Garwood, N. J. Catalog JF-61, in color, lists clamp assemblies, fixture components, spring plungers, fixture details and torque screws.

For more data circle 53 on Postpaid Card

Corrosion Resistant Steels

American Metal Climax, Inc., Climax Molybdenum Co. Div., 1270 Ave. of the Americas, New York 20, N. Y. 60-page booklet describes in detail the development of corrosion resistant steels based

on the use of molybdenum, copper and nickel, together with sufficient chromium to retain the resistance to oxidation provided in the familiar chromium and the austenitic chromium-nickel (18-8) types of stainless steel. Numerous tables. charts. and photographs are included.

For more data circle 54 on Postpaid Card

Cutting Tonis

Keo Cutters, Inc., 25040 Easy St., Warren, Mich. Catalog covers the Keo line of standard cutting tools which include combined drills and countersinks, keyseat cutters, arbor type keyseat cutter, cutter ream-ers, lathe mandrels and machine countersinks. Also illustrated are many types of special tools-long drills, special tapered shank drills, drill and spot facers, bell type center drills. keyseat and teeslot cutters, hubsaws, screw slotters, angle cutters and many others. For more data circle 55 on Postpaid Card



DETECT and CORRECT "OFF-TIMING" IN AUTOMATIC OPERATIONS

New, portable Sheffield Monitorecord® helps you achieve proper timing, and sequence of cycles in automatic machining, gaging, transfer, and assembly machines. It charts duration and relationships of up to 14 different cycles. Comparison with master chart lets you diagnose and correct trouble. Machine can pay for itself in one use. Write for bulletin AU-108.

The SHEFFIELD Corporation . Dayton 1, Ohio

A subsidiary of The Bendix Corporation
For more data circle 408 on Postpaid Card

A new advance in synthetic coolants

The first chemical coolants were outstanding in controlling rust and rancidity. They have done a good job and are widely accepted for many metal removal operations.

Because they were not heavy-duty fluids, our research department continued its search for a chemically-conceived coolant that could take the place of highly fortified straight oils. The result is new Hocut 3210—a significant advancement in the science of machining coolants.

Hocut 3210 is a highly fortified water-soluble concentrate. It has outstanding anti-weld and extreme pressure characteristics. As a result, it does better those jobs previously reserved for fortified straight oils. Hocut 3210 improves finish at higher speeds without sacrificing tool life. Additionally, it eliminates smoke, oil fog and inherent fire hazards.

Hocut 3210's E.P. characteristics are released by the heat of the cutting operation. This forms a barrier between the tool and the work resulting in a clean cut, free from any welding of chip to tool. Tool life is increased, surface finish improved and parts come off the machine cool enough to handle.

Its heavy duty ability makes it an ideal coolant for tough jobs such as tapping, broaching, form grinding, internal and external thread cutting, thread rolling, plunge grinding, etc.



In spite of all the outstanding features and capabilities of Hocut 3210, its cost is most reasonable. To be up to date on this latest coolant advance, write for complete data or ask your nearby Houghton Man for a test in one of your tough jobs. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Houghton

INDUSTRY'S PARTHER IN PRODUCTION

For more data circle 409 on Postpaid Card

free literature . . .

Machining Hollow Parts

Alcoa Aluminum Co. of America, 731 Alcoa Bldg., Pittsburgh 19, Pa. Brochure entitled "The Hole Story" gives details on material cost savings when aluminum hollow screw machine stock and me-chanical tube are used in place of solid stock. Tabular data outline machinability and corrosion resistance ratings. mechanical properties and specifications of the various alloys, and the range of sizes and alloys offered.

For more data circle 56 on Postpaid Card

Soluble Cutting Oils

Shell Oil Co., 50 West 50th St., New York 20, N. Y. Technical bulletin contains a guide to soluble oil selection and dilution rates for specified machining operations on steels, irons, alloys, aluminum, copper and copper metals.

For more data circle 57 on Postpaid Card

Surface Grinding Machines

Brown & Sharpe Mfg. Co., Machine Tool Div., Providence 1, R. I. Bulletin GM 62, in color, gives complete specifications and includes illustrations covering the principal construction features, operations and optional accessory equipment for the four new

Micromaster Surface Grinding Machines. The four sizes of machines covered are the 8 by 24 inch, 10 by 24 inch, 12 by 24 inch and 10 by 30

For more data circle 58 on Postpaid Card

Arbors, Chucks and Gages

A & C Engineering Co., 12024 E. Nine Mile Rd., Warren, Mich. 6-page HydraLock Bulletin, AC-100, in color, explains the function and where and when usage is recommendedfor hydraulic expanding arbors, chucks and gages. Illustrations of applications show both manual and automatic actuation. Drawingsand photos are also included.

For more data circle 59 on Postpaid Card

Locknut

Allen Manufacturing Co., Hartford 1, Conn. 4-page leaflet, in color, describes the gen-eral-purpose Allen Lokon Locknut. Dimensions are also included.

For more data circle 60 on Postpaid Card

Hold Everything!

That's what Modern has been doing with Collets-Pushers-Tubes,-for over Three and one Half Decades.

> Progressiveness, along with Experience over the years, has brought about a most reliable and dependable source-"Modern"!

Finished Collets, Pushers, Tubes, Master and Pads are carried in stock,-Available for Immediate Delivery.



BURNS PUSHER

The "Burns" Pusher handles stock without Scratching or Friction;-Also an excellent pusher for Hot Rolled Steel.



MODERN DUAL-GRIP **PUSHERS** for Stock Saving.

DOUBLE SAW TOOTH SERRATED COLLET

Modern Collets are available in all types and sizes for ALL screw machines.



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Phone or write for stock list of finished items—available for immediate delivery.

MODERN COLLET AND MACHINE COMPANY Ecorse (Detroit) 29, Mich. 401 Salliotte St.

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Suddenly complex finishing has a simple solution!

The Pangborn Vibratory Finishing Machine has an unusually wide range of application. What would you like to descale, deburr, radius, finish or burnish?

Metal and metal alloy as well as many plastic and ceramic parts may be vibratory finished. This machine processes extremely small and delicate items with the same facility it handles large and heavy objects.

What's more, the Pangborn Vibratory Finishing Machine performs as much as 100 times faster than conventional equipment. Cuts costs? You bet!

All sizes of the machine come equipped with variable speeds and amplitudes plus new improved air-cushioned suspension. Option-

al air-cushioned floor mounts completely eliminate any transmission of vibration to the floor. Auxiliary equipment and the best in media and compounds are available for your every need. Send parts with exact finish specifications or finished specimen for sample processing in our laboratory to Mr. William E. Brandt at:

PANGBORN CORPORATION, 5600 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada—Manufacturers of Vibratory Finishing, Blast Cleaning, Dust Control Equipment — Rotoblast® Steel Shot and Grit®.

Pangborn

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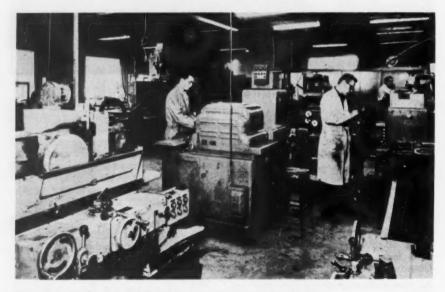


DIAMOND APPLICATION DEVELOPMENT LABORATORY

A new Diamond Application Development Laboratory facility has been put into operation by the Metallurgical Products Department, General Electric Co., 11109 East Eight Mile Rd., Detroit 32, Mich. The new facility has been set up to investigate new and improved diamond applications, to evaluate new G.E. man-made dia-

mond types and to analyze comparitive performance testing operations. The laboratory is equipped with a variety of standard grinding machines having special modifications to permit accurate control of the many variables which affect diamond performance.

E. L. Kapernaros has been named manager of the facility. A graduate of the Missouri School of Mines with a degree in metallurgical engineering, Mr. Kapernaros joined General Elec-



View of the new G.E. Diamond Application Development Laboratory shows some of the specially modified standard grinding machines used in evaluation and test work.

tric in 1956 as a sales engineer in the cemented carbides section. In 1959 he became an application development engineer in the diamond product section, the position he held prior to his new appointment.

* modern machine shop *

NATIONAL ACME LICENSES MITSUBISHI

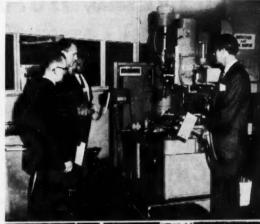
The National Acme Company, Cleveland, Ohio, has announced the signing of an agreement licensing Mitsubishi Shipbuilding & Engineering Company, Ltd., of Tokyo to manufacture machine tools in Japan. This agreement is subject to Japanese Government approval and covers models of "Acme-Gridley" multiple-spindle automatic machines. Mr. Kenpachi Taniguchi, managing director of Mitsubishi, has been in Cleveland to conclude negotiations.

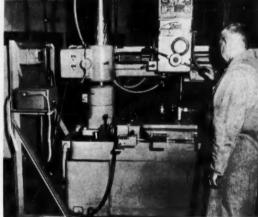
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NUMERICAL CONTROL WORKSHOPS

A unique series of workshops on numerical control was recently held at the Diehl Manufacturing Company's Somerville, N. J., plant where the Singer Numerical Control units are produced. The purpose of the program was to explain the importance of control systems to persons in the metalworking field. Visitors learned how to study drawings and prepare program tapes for control units.

Singer units were in operation on an Atlantic Jig Borer, a Fosdick No. 30 Jig Borer, a Veetmatic Gantry Drill and a Fosdick Sensitive Drill. Also on display but not in operation was a Wade Experimental Unilateral Finishing Lathe. The Singer is a two axis positioning unit accurate to plus or minus 0.001 or 0.0002 inch, depending on the particular machine tool. Input is either the EIA eight channel per-





(Top View) Observing the operation of a Veelmatic Gantry Drill with a Singer control at a recent Diehl Manufacturing Co. Numerical Control workshop are E. Smith, Methods Supervisor McKiernan-Terry Corp.; L. Pataky, Superintendent McKiernan-Terry Corp.; F. Babis, Machine Operator; G. Hipko, Manufacturing Engineer, Waldron Hartig Corp. (Hidden); H. Dalay, Diehl Sales Engineer; and (right) R. Egan, Unit Supervisor, Curtiss-Wright Corp. (Bottom View) An electronic wafer with 20 holes held by a universal chuck and clamps is accurately positioned by a Singer control unit. The program is contained in the short length of tape in the reader shown on the left.

forated tape or a decade control. Auxiliary functions can also be programmed in the perforated tape.

The workshop was arranged so that visitors could go to the various machines and observe their operation and ask questions about any particular phase of N/C from the study of the engineering drawing to the removal of the machined part from the machine.

CARPENTER CONSTRUCTS COLD ROLLED STRIP DEPARTMENT

The Carpenter Steel Company has announced that construction has been started on a new cold rolled strip mill building at its West Shore property in Reading, Pa. The new facility, when completed, will replace existing cold rolling capacity at the Reading plant.

Substantial purchases of new mill equipment are to be made as a part

of the program, including a Send-zimir mill and related equipment for precision cold rolling, and replacement of an existing 4-hi cold rolling mill with a precision 4-hi mill equipped with various gaging and size control devices.

* mms *

BURGMASTER ELECTS PRESIDENT

Mr. Joseph L. Burg, former vice president of Sales and Engineering, Burgmaster Corporation, 15001 South Figueroa



Joseph L. Burg

CHICAGO° PRESS BRAKES

UNEXCELLED ACCURACY



Press Brake Dies Straight-Side-Type Presses Hand and Power Bending Brakes Special Forming Machines

158



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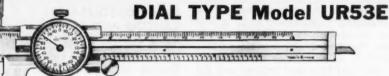
on any press brake work upon request

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Production Tool Specialties 702 Howard Street INDIANA-Anderson

A. O. Barnes Co., 621 John St. South Bend Cutting Tools, 432 Fellows St.

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KENTUCKY—Louisville Wilhelm Tool Agency

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North Grafton Sterling Sales, Inc., P.O.B. H West Springfield Tri-State Industrial Supply Co. 149 Wayside Avenue

Worcester W. T. McBride, Inc., 6 Park Ave.

MICHIGAN-Detroit Borel & Dunner, 19313 Farmington Precision Tool Repair Co., Inc. 923 East Eight Mile Road Ralph's Indicator Service 20245 Van Dyke Dearborn

Swiss Precision Tools, 4779 Korte Av. **Grand Rapids** Snoap Mill Supply 510 Lexington Avenue N.W.

MINNESOTA - Minneapolis Wm. K. Nelson, 807 13th Ave. So. David T. Olson Sales Corp. 1412 Foshay Tower Service Tool & Engineering Co. 521 South 7th Street

NEW JERSEY-Hillside Rayson's Supply, 378 U.S. Hwy. 22 NEW YORK—Buffalo Winiewicz Hdwe., 1069 Broadway

Manilus House of Tools, P.O. Box 127 Mount Vernon Electra Industrial Distributors 625 So. Columbus Ave. New York City

Paul Gesswein & Co., 35 Maiden Lane New Rochelle H. S. Williams, 11 Alpine Road

Ozone Park, Long Island R&D Machine, 106-45 98th St. Rochester

Kress Tool Co., 565 East Main St. N. CAROLINA—Greensboro Remco Supply, 1815 E. Wendover Ave. OHIO-Cincinnati

Tool Sales & Service of Cincinnati 325 Bank Avenue Cleveland Dessil Tool & Sup., 1616 St. Clair Myers Tool Service, 15601 St. Clair Dayton Monnier Tool & Sup., 728 S. Main

Elyria Royal Supply, 163 Buckeye OKLAHOMA—Tulsa

W. L. Riggs Co., P.O. Drawer R OREGON-Portland OREGON—Portland
Hall Tool Co., 1724 S. E. Grand Ave.
Sam A. Mesher Tool Company
1033 S.W. Front Street
PENNSYLVANIA—Philadelphia
Casanave Supply, 2028 Sansom St.

Pittsburgh Merit Mchry., 2311 Babcock Blvd.

TEXAS-Houston Bob Machine Tool, 5115 Cornish Esco, Inc., P.O. Box 22194 A. J. Rod Co., 5011 Navigation Blvd. VIRGINIA-Richmond

Associated Sales Co., P.O. Box 1019 Salem ShenTool, Box 846

WASHINGTON-Seattle Aronson's Hdwe., 1st Ave. at Pike WISCONSIN—Madison Gordon Eng., 1882 E. Main St.

Milwaukee Jordan Engineering & Tool Sales 7727 West Burleigh Street National Supply & Hdwe. Co. 1235 North 3rd Street

St., Gardena, Calif., has been elected president of the firm at a recent meeting of the Board of Directors. Mr. Joseph Burg has been with Burgmaster Corporation since it was first founded in 1945, after returning from the armed services. He participated in all the major developments of the Tool Flex tool holders and the Burgmaster Turret Drilling Machines.

At the same meeting, Mr. Fred G. Burg, former president of the firm, was elected Chairman of the Board.

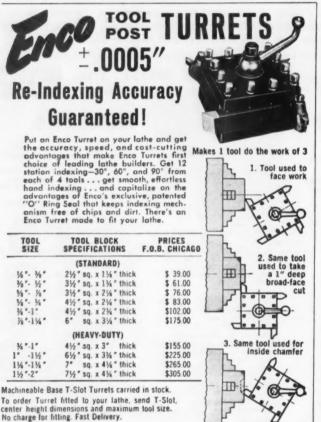
* modern machine shop *

BLISS CONSOLIDATES CANTON AND SALEM INTO SINGLE DIVISION

The consolidation of Salem and Canton operations of the E. W. Bliss Company into a single Heavy Equip-

ment Division. has been recently announced. Mr. George Perrault, Jr., presently vice president and manager of the Salem Division. will manage the new division and his headquarters will be in Salem. Corporate headquarters for the E. W. Bliss Company will continue to be located in Canton.

Geographically, the two plants of the new Heavy Equipment Division are only 30 miles apart and their facilities are complementary. Each plant is equipped to handle heavy metal sections from fabrication or casting through heat treating, machining and assembly and the combining of these two units into a single operating facility



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with approximately a million square feet of floor space, will enable the company to expand its activities in the custom built machinery field. The move also provides a more versatile contract manufacturing capability than has previvously been available.

Production of the new Division will include the company's complete line of rolling mill equipment, heavy mechanical and hydraulic metalworking presses, large custom machinery, and special contract items. Participation in the manufacture of the company's aircraft overrun safety barriers, catapults and similar products, is also intended for this new division.

* modern machine shop *

Lloyd Tool Corporation, manufacturers of Koolmist Coolant Genera-

tors, has moved into a new, modern plant with up-to-date equipment. The new plant is located at 1222 N. Fair Oaks Ave., Pasadena, Calif. Lloyd Tool Corporation has developed a mist coolant system which will cool and lubricate twelve or more gang milling cutters with a single spray outlet. This spray unit can be used for all heavy duty machining and grinding operations.

Lloyd Tool Corporation will expand and feature the manufacturing of a new type of soluble oil coolant without objectionable odor which is made especially for mist coolant systems. Special automatically controlled chemical mixing equipment will be used in com-



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pounding this new product. Lloyd Tool Corporation is also making two new types of industrial degreasing fluids for cleaning machinery. which can be used with special hand mist sprayers for speeding up the cleaning of all types of machinery. Two new cutting oil products are already being manufactured for use with all flood cooling methods.

mms

FOWLER APPOINTED AMERICAN AGENT FOR JAPANESE FIRM

The Mitutoyo Co. of Japan, leading manufacturer of precision measuring tools, has launched a world-wide expansion program by appointing the Fred V. Fowler Co., Auburndale. Mass., as its exclusive American agent. The Mitutoyo program will be developed in four areas: (1) by expanding its line through research and development; (2) by producing high quality precision instruments; (3) by competitive pricing; and (4) by expanding its world markets.

The Mitutovo Co. manufactures, among other measuring instruments, various vernier calipers, micrometers, dial gages, dial test indicators, height gages. and comparators.



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MODERN MACHINE SHOP 163

A.M.T.D.A. ELECTS OFFICERS

The American Machine Tool Distributors' Association has announced the election of Irvine B. Rabel, president of Star Machinery Co., Seattle, Washington, as president at its Thirty-Seventh Annual Meeting, which was held recently in Pittsburgh.

Among the other officers elected to new positions at the meeting were: C. Denson Day, president of Machinery Associates, Inc., Wynnewood, Pa., became vice president; William L. Walker, president of Walker Machinery Co., Cincinnati, Ohio, second vice president; and Robert W. Nissen, president of The E. L. Essley Machinery Co., Chicago, Ill., secretary-treasurer. John L. Addy, Jr., partner in the Addy and Luby Machinery Co., Detroit, Mich.; Robert A. Brechter, vice president and secretary of Van-



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. B. Rabel C. Denson Day





William L. Walker Robert

Robert W. Nissen

dyck Churchill Co., New York, N. Y.; and Phil R. Hoffman, vice president of Hoffman-Marquard Machinery Co., St. Louis, Mo., were elected to the Executive Committee.

* modern machine shop *

MORRIS TRAVELING DISPLAY

The accompanying illustration shows views of an interesting traveling display of machine and production tools sponsored by the Robert E. Morris Co. (REM Sales Corp.), West Hartford 7, Conn. The display comprises a 1954 Ford bus which has had the roof raised to permit full headroom inside. A 9 kw. motor generator set driven by a 14 h.p. gasoline engine provides 220-volt 3-phase current for the heavy machinery and 110-volt single-phase current for lights and air compressor.





Illustration showing interior and exterior views of the Morris Traveling Display.

The equipment displayed is changed from time to time to exhibit new products as available. Since putting into operation in June 1960, the display has traveled extensively in all six New England states. Presently displayed are a Harrison 11-inch x 24-

inch tracer lathe, a Hammond universal belt grinder, a Boyar-Schultz 6 x 18-inch surface grinder, and a Walker-Turner drill press with a Commander tapper. In previous trips, a Burgmaster 6-station turret drill has been displayed. All of this equipment is set



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up to demonstrate in operation.

Not only is this traveling display used for plant demonstrations throughout New England states but also for local ASTME meetings, and so on. One of its principal uses is to introduce new products which are too large for a salesman to carry in his car.

MICHIGAN TOOL ANNOUNCES NEW DIVISIONAL HEAD

Michigan Tool Company, Detroit, has appointed Richard W. Hallock as manager of its Enterprise Division. Enterprise, located at 7171 East Mc-Nichols, Detroit, specializes in high precision gears, prototype and experimental parts and dies.

Mr. Hallock, formerly assistant to the manager of the company's

> Manistee Iron Works Division. Manistee. Michigan, originally joined the companyin 1951 where his first assignment was to supervise the erection of salt evaporator units in Rio de Janeiro. Brazil and Caracas. Venezuela. Prior to joining Manistee Iron Workshewas vice-president of Rademaker Chemical Co.

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MIMIK EXPANDS FOREIGN MARKETS

m m s

As a further step in securing world markets for the Mimik hydraulic machine tool tracer attachment, Mimik Tracers Inc., 3901 Union Rd., Buffalo, N. Y., has set up headquarters in Frankfurt AM Sued, West Ger-

many. This follows the establishment of a sales and service organization in Britain last year at Newton Abbott

Engineering Co. Ltd.

Reinhold Schomann, a Mimik trained technician, has been appointed in charge of demonstration equipment which will be shown to German metalworking executives at the Wuery and Lindner Company, Quirin Strasse 4, Frankfurt AM Sued.

* modern machine shop *

BESLY-WELLES INTRODUCES COLOR-KEYED TAP PACKAGING

Besly-Welles Corp., South Beloit, Ill., has introduced colorful, re-usable polyethylene cigarette package sized containers for Besly Taps which are now color keyed to the recently intro-



View of Besly Taps which have their own Color-Coded package for instant identification.

duced Besly Tap Selector program to further simplify ordering and inventory of production taps. Orange colored boxes now contain straight fluted

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SPEED UP PRODUCTION with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets... do multiple punching, steel-rule die work and other high output operations. For rapid, shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch... Ask for new catalog.



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Choice of over 30 models and types in 5 to 60-ton sizes



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taps as color-coded in Besly wall charts and tap selector booklets. Green packaging denotes spiral pointed taps, blue—Besly X-Press Taps, and red packages are used for special taps.

Besly Color-Keyed Tap Selection is a marketing innovation designed to simplify the specification of the proper tap in 75 percent of all tapping applications. The tap user need only know the material to be tapped, and four colors.

* modern machine shop *

SHEFFIELD BOARD CHAIRMAN HONORED BY STANDARD ASSOCIATION

Louis Polk, board chairman of The Sheffield Corporation, Dayton, Ohio, and director and vice president of The Bendix Corporation was awarded the American Standards Association How-



Louis Polk (left) is awarded the American Standards Association's 1961 Howard Coonley Medal by J. R. Townsend, ASA President.

ard Coonley Medal recently at the 12th National Conference on Stand-



ards, Houston, Texas. The award is in recognition of Mr. Polk's almost three decades of leadership in establishing high standards for dimensional quality control for the service he has rendered to the advancement of standardization and the understanding of its significant role in the American economy.

As president of Sheffield from 1941-1960, Mr. Polk guided the development of many types of pneumatic and electronic measuring instruments which

are said to assist all manufacturers in maintaining high standards of quality.

* mms

Do ALL PROMOTIONS

William R. Matthiesen has been promoted to president and district sales manager of the DoAll Toledo Co. For the past six vears Mr. Matthiesen has been a sales engineer for the DoAll Detroit Co. He will be available to help the manufacturersin northwestern Ohio and southeastern Michigan improve their cutting and finishing techniques on all kinds of materials.

Louie L. Etheridge has been appointed vice president and general manager

of DoAll Tennessee Co., 1923 Church St., Nashville, Tenn. The company serves manufacturers in Tennessee and the western half of Kentucky with machine tools, cutting tools and precision gaging equipment.

* modern machine shop *

RACINE FORMS SUBSIDIARY

A wholly-owned subsidiary, Nihon-Racine, has been formed at Tokyo by



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Racine Hydraulics & Machinery, Inc., Racine, Wis., to administer its hydraulic business in Japan.

George B. Miller, executive vice president, and Gordon C. Fuller, international manager, together with K. Miyoshi of Tokyo, will serve as directors of the subsidiary.

OK TOOL FORMS NEW COMPANY WITH FIRTH BROWN

The OK Tool Company, Inc., Milford, New Hampshire, and Firth Brown Limited, Sheffield, England, have announced the formation of a joint company to be known as Speedicut-OK Tools Limited. Headquarters for the new company will be in Sheffield, England. Speedicut-OK Limited

will become official sole selling agents in the United Kingdom, serving old and new customers of OK Serrated Blade Milling Cutters and OK Shankless Single Point Tools for planers, shapers, lathes, and boring mills. The entire line of OK cutting tools, including custom engineered multiple operation tools will be manufactured by Firth Brown Tools, Limited, under the latest methods developed by the American concern.



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JOHN S. MORTON

John S. Morton, Director of Engis Equipment Company, Chicago, died suddenly after a successful minor operation. Mr. Morton was born

m m s

and educated in Germany and resided in the United States for more than thirty years. He has been associated with Engis Equipment Company as Chief Chemist in charge of Research and Development and the production of Hyprez Diamond Compounds for twenty years.

* modern machine shop *

PERKINS ACQUIRES SPIRAL BEVEL GEAR LINE

Perkins Machine and Gear Co., West Springfield, Mass., has announced the acquisition of the entire inventory of standard stock spiral bevel gears from the Precision Gears and Products, Inc., of Paterson, N. J. The purchase includes finished stock and engineering specifications.

This acquisition makes Perkins one of the largest manufacturers and distributors for this type of gear. It is of great importance to manufacturers with equipment incorporating these gears as it is said to assure a complete stock and a continued source of supply to meet requirements promptly.

GRINDERS

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The United States Electrical Tool Co.

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NATIONWIDE NUMERICAL CONTROL SEMINAR SCHEDULE ESTABLISHED

Numerical Control—a revolutionary development in metalworking—will be explained at seminars across the country to be conducted jointly by the National Machine Tool Builders' Association and the American Machine Tool Distributors Association. Presenting these courses for the association is Mr. Jack Moorhead, an outstanding training specialist with fifteen years experience. His sole work in the past five years has been in Numerical Control and he has already conducted twenty-five similar courses in the United States and Canada.

In a joint statement the associations said "We believe that Numerical Control is one of the most significant developments in metalworking in many years. This course is in response



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Jack Moorhead, Training Specialist

to many requests for objective information on Numerical Control. Concerned only with the broadest possible dissemination of information on basic principles of this new philosophy in manufacturing, the course does not favor any of the several types of equipment. While the course eliminates the mystery in N/C, attention also will be given to the many types of machine tools which can greatly increase productivity."

The two day course, which is designed especially for key executives in manufacturing firms, their engineers, production officials, sales people, and for machine tool builders and distri-



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butors, will be given in key cities across the country on the following schedule: Los Angeles, December 4-5, Biltmore Hotel; San Francisco, December 7-8, Jack Tar Hotel; St. Louis, December 18-19, Statler Hilton; Cleveland, January 8-9, Statler Hilton; Cincinnati, January 11-12, Netherland Hilton; Chicago, January 22-23, LaSalle Hotel; Detroit, January 25-26, Sheraton-Cadillac; Philadelphia, February 5-6, Marriott Motor Hotel; Boston, February 8-9, Hotel Kenmore; Atlanta, February 19-20, The Dinkler Plaza; Dallas, February 22-23, Hotel Adolphus, Reservation forms may be obtained from Eugene Koschella, Director of Technical Services, National Machine Tool Builders' Association, 2139 Wisconsin Ave., Washington 7, D. C. or by circling No. 61 on the reader service card provided in this issue.

Wilson "Superficial" makes Shallow Measurements Accurately

Wilson Rockwell Superficial hardness testers are used to measure surface hardness, coatings, thin metal or thin hard cases. The hardness test is based on a penetration of less than .005", and Wilson Superficial testers have the precision and ease of operation to give accurate readings every time.

Accurate — Precision-built for consistently correct results.

Knife-edge bearings provide near-frictionless operation.

Easy to operate—Controls conveniently grouped—oil dash-pot system provides smooth load application.

Long testing—Simple design, rugged construction make Wilson Superficial testers as durable as a machine tool.

Complete line available—Wilson Rockwell hardness testers and accessories are available in a wide variety for every hardness testing function. Also "Brale" diamond penetrators for perfect readings every time.

Write for details—Ask for Catalog RT-58. It gives complete information on the Superficial tester as well as on the full line of Wilson Rockwell hardness testers.



Wilson Rockwell Superficial Haraness Tester

WILSON "ROCKWELL" HARDNESS TESTERS

Wilson Mechanical Instrument Division American Chain & Cable Company, Inc.

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EQUIPMENT

SURFACE GRINDERS

Alina Corporation, 122 East Second St., Mineola, L. I., N. Y., has been named the sole U. S. representative for the ELB line of high precision surface grinders, ELB surface grinders cover 35 models with sizes ranging from 6 by 12 by 73/4 inches to 59 by 197 by 391/2 inches.

ELB's outstanding advantages are: fully automatic work cycle; simple to operate; modern, functional design; increased output due to widest cross feeds (up to 23/8 inches per table stroke); profile grinding with 4 inch



View of ELB High Precision Surface Grinder

wide grinding wheel; automatic copying grinding; automatic sizing equipment and automatic return of wheelhead to starting position.

For more data circle 62 on Postpaid Card

* modern machine shop *

3-WAY BED LATHES

Farrel-Birmingham Company, Inc., Consolidated Machine Tool Div., 565 Blossom Rd., Rochester 10, N. Y., has introduced a 3-way bed heavy-duty general purpose and roll turning lathe available in sizes ranging from 32 to 92 inch swing over the bedway. The lathes incorporate a number of innovations designed to increase productivity. improve accuracy and reduce handling time. The company claims, there is more rigid support of the work because the cutting force resultant falls between the front and middle ways. There is more rigid support of the work because it is not necessary to extend the tailstock quill, to reach across the carriage bridge, in facing the end of the workpiece. The carriage will pass completely by the tailstock.

The ability of the carriage to pass the tailstock, as well as the steadyrests, results in less setup time. This is particularly effective when two carriages are used on long lathes. The carriage is arranged for the application of numerical and/or tracer control. The new "Rotorak" feed incorporates a sectional threaded rack with

and

MATERIALS

a pair of large, adjustable screws for backlash control. As the rack sections are short and accurately spaced, there is no limit to the length of bed that can be supplied. The new carriage feed system eliminates the need for a lead screw, shifter mechanisms, etc.

From the carriage, the operator has finger-tip centralized control of all operations. The user can observe the

cutting tool and has complete control of it from his work station. The head-stock spindle is driven by a direct-current, adjustable speed motor with a 4-1 speed range. This drive, in connection with four mechanical speed changes, provides a wide range of operating speeds. Large chip-disposal areas are provided in the bed. For lathes with 40 or 50 inch wide beds,

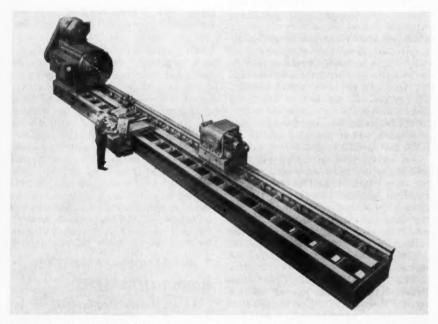


Illustration showing the 3-Way Bed Heavy-Duty General Purpose and Roll Turning Lathe

chip disposal is through the rear bed wall. Larger sizes are designed for center of bed chip disposal. For these, a conveyor can be installed to carry the chips to either a bucket or verticallift conveyor for removal from the pit. For more data circle 63 on Postpaid Card

* modern machine shop *

INDUCTION HEATING EQUIPMENT

The National Automatic Tool Company, Inc., Route U.S. 40, Richmond, Ind., has announced a line of Natco-Delapena High Frequency Induction Heating Equipment. Through a crosslicensing agreement with Delapena and Son, Limited of Cheltenham, England. Natco is now in a position to offer a versatile line of oscillator tube and motor generator equipment. Among the many advantages of the oscillator tube equipment are three principal devices for varying the power under all output conditions while still maintaining maximum efficiency. One is a unique infinitely variable matching transformer arrangement providing fine control over power output. The second is the special matching link connections for single or multiturn work coils. The third is a booster condenser which provides additional KVA for specific loads.

An outstanding advantage of this unit is the use of an air cooled oscillator tube which is said to provide six hundred percent longer life. It also gives a much higher intermittant rating than the equivalent water cooled tube. In addition to the tube, the cabinet is also sealed and air cooled, practically eliminating the use of water cooling.

The Natco-Delapena "Cold Heat Process" features the use of an efficient "Intensifier." This device is particularly advantageous, according to the company, for hardening gear



Closeup view of Natco Traversing Head and Intensifier for gear hardening machine.

tooth profiles as distortion is reduced to a minimum, tooth loading can be increased over normal through hardening, and scaling is completely eliminated. This process makes possible a good hard wearing surface yet retains the original tough metal structure of the tooth form, thereby reducing noise level.

Oscillator tube generators are available in sizes from 4 kw to 200 kw in either single or double output voltages.

Standard motor generator equipment is available in sizes from 15 kw to 300 kw. Higher outputs are possible through the use of paralleling systems. For more data circle 64 on Postpaid Card

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EIGHT-INCH SHAPER

An eight-inch shaper designed for accuracy, speed and efficient production in many applications has been

introduced by Havir Manufacturing Co., 434 Cleveland Ave., St. Paul, Minn. The machine is called the "Shape-Rite" shaper and is said to be ideal for tool and die makers and instrument manufacturers for work that can be machined on a full eightinch shaper. The unit's key feature is that it produces extremely fine finishes. The bull gear and pinion are cut right hand helical angle. The drive gear and pinion are cut left hand helical angle. This feature actually gives users a herringbone gear effect to the finished surface, adding extra smoothness without gear-tooth reproduction on work, according to the manufacturer.

All operating surfaces of the Shape-Rite Shapers are ground and hand scraped. Each part is fitted closely to insure positive operational accuracy and long life to parts. Each shaper comes equipped with swivel tables, especially good for tool work and shap-



Havir "Shape-Rite" Shaper—44 inches long, 24 inches wide and stands 51 inches high

ing molds. The column is heavily constructed, cross ribbed and made of special alloy cast iron. The unit has extra large vee ram bearings and heavy front vertical ways for cross rail to guard against table deflection. Cross rail and table saddle are heavily constructed to insure extreme rigidity. The ways on the ram are vee-type, and they are extra long. The tool head swivels to any desired angle.

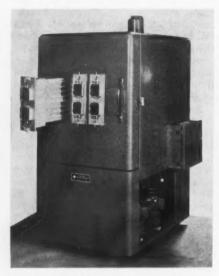
Standard equipment includes swivel table, swivel base vise with steel faced jaws, tool post wrenches, necessary cranks and motor drive arrangements. Bearings are Timken roller on bull gear with single and double row ball bearings on gear shafts. The Shape-Rite Shaper is 44 inches long, 24 inches wide and stands 51 inches high. For more data circle 65 on Postpaid Card

* modern machine shop *

TEMPERATURE CHAMBER

Cincinnati Sub-Zero Products, 3930 Reading Rd., Dept. S-1, Cincinnati 29, Ohio, has introduced a temperature chamber, which is engineered to hold three modules, capable of testing 150 component parts simultaneously; over a range of minus 100 degrees to plus 350 degrees F. Model SU-100-10-HC, ten cubic foot stainless steel chamber, is especially adapted to non-destructive as well as life testing of diodes, resistors, capacitors, transistors, and other component parts, according to the company.

The sliding modules, equipped with silastic insulation for the complete sealing of the temperature chamber, are said to be accessible at all times. Any one module can be withdrawn from its rack without opening the chamber door, altering the testing temperature, or disturbing the other two under test. The chamber, 30 inches high, 24 inches wide and 24 inches deep, is equipped with fin coil evaporator on the rear wall, 1000 watt heat-



Model SU-100-10-HC Temperature Chamber

ers, and air baffle, to assure an even temperature distribution by the elimination of hot spots and stratification. Units of this type are custom engineered to accommodate all types of modules. The temperature range is comprehensive and sufficiently broad to comply with all requirements for this type of testing.

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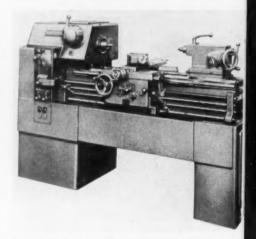
TOOL AND DIEMAKER'S LATHE

R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio, has introduced a dual drive tool and diemaker's lathe which features an apron reverse to leadscrew, single-lever selection of 16 speeds from 31 to 2,400 r.p.m. and built-in horsepower meter. The company claims, the dual drive headstock provides 12 gear-driven spindle speeds for positive power in the lower ranges

and 4 belt-driven speeds for smooth power in the high range. The 3-bearing spindle uses "zero" precision Timken bearings. Lubrication is automatic forced-feed. The electric clutch and brake provides smooth and positive stops and starts.

Reverse to the leadscrew and feed is controlled from the rigid one-piece apron. A single lever engages both cross and length feed through a positive-jaw clutch. A single trip for feeding and chasing in each direction (spindle forward only) is standard. Quick-set dials are provided for both cross feed and compound rest. Fortyeight feed and thread changes are available through the totally-enclosed quick change box (lubricated automatically). A safety interlock is said to prevent engagement of course feeds while in the high speed range. A dial at the end of the spindle provides convenient indexing for chasing multiple threads.

The thrustlock tailstock puts the handwheel at a convenient angle to the operator and provides full-length support to the spindle. A dial is provided to measure spindle travel.



LeBland Dual Drive Tool and Diemaker's Lathe

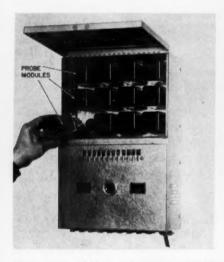
Clamping is said to be quick acting. The dual drive's heavy duty style bed employs replaceable hardened and ground steel ways, fitted to LeBlond's compensating veeway principle. Cutting forces are transmitted into the bed efficiently for long-lived accuracy and minimum wear, according to the manufacturer.

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★ modern machine shop ★

TRANSISTORIZED CONTROLS FOR AUTOMATIC MACHINERY

The Weldotron Corp., 907 Frelinghuysen Ave., Newark 14, N. J., has announced the availability of an electronic control. This line of fully transistorized Sensomatic controls are said to be easy-to-install, pulse logic monitoring devices which continuously check and control automatic machine operations. They will stop a machine immediately upon detecting any malfunction such as misfeed, improper



View shows Weldotron Sensomatic Model 1200 Multi-Station Detector which will monitor machine operations of up to 12 stations.



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MODERN MACHINE SHOP

170

positioning, improper parts transfer, buckling, end of material, preventing tool and machine damage and material waste. These units respond instantly when trouble develops and in addition pin points the source of trouble, according to the company. These units may be used for Waterbury Farrel and Baird Eyelet Presses, punch presses, press brakes, sheers,

forging machines, die casting machines, thread rolling machines, cut off machines, screw machines, automatic lathes, riveting machines, sorting machines, four slide machines, zipper machines, and many others.

Sensomatic units are ruggedly constructed units with no moving parts in operation. They require little power and feature fail-safe, dust free circuitry encapsulated in epoxy resins for maximum resistance to shock.

moisture and other detrimental environmental conditions. The illustration shows the Sensomatic Model 1200 Multi - Station detector which will monitor machine operations of up to 12 stations. If a malfunction occurs at any one station the machine is instantly stopped and a visual signal alerts the supervisor. The exact location of the trouble is pin pointed and reported by individual indicator lights on the front panel of the control, according to the company.

For more data circle 68 on Postpaid Card

* mms *

Micro - adjustable boring bars with throwaway inserts have been intro-

WHAT'S YOUR SHOP COST PER HOUR FOR WAGES AND OVERHEAD?

If it's \$6.00 you spend 10 cents per minute. If it's \$7.20 you spend 12 cents per minute.



3 cuts - 6 finished ends.

Cuts like these are made in SECONDS!

\$6.00 per hour = 1/6 cents per second.

\$7.20 per hour = 1/5 cents per second.

WHEN YOU CAN CUT AND

FINISH LIKE THIS (Total time 58 seconds) THAT'S FAST! WHY DON'T YOU INVESTIGATE TO SEE WHAT YOU ARE MISSING.

Write and ask about "Cut-Machining."

WALLACE SUPPLIES MFG. COMPANY

1804 W. Cornella Ave. • Chicago 13, Illinois

or Check Item 430

duced by Vascoloy-Ramet Corporation, 890 Market St., Waukegan, Ill. This unique concept of boring bar design combines the V-R micro-adjustable feature for quick, positive and accurate diameter adjustment in increments of 0.001 inch with the inherent economies of V-R carbide throw-away inserts. Light, medium or heavy cuts are possible because of chip control provided by the built-in, adjustable chip breaker.

V-R micro-adjustable boring bar

applications are being made on automatic or hand screw machines, boring mills, turret lathes, multiplespindle bar machines, and so on. Combined operations can be effectively incorporated through multiple insert designs in a limitless variety of single or multiple diameters, because "throw-



View of Micro-Adjustable Boring Bars

aways" permit "free" design without regard for the maintenance grinding restrictions of conventional tooling.

V-R micro-adjustable boring bars with throw-away inserts are available in three basic styles — a style with interchangeable heads for finish boring diameters from ½ inch to 1½ inches, a style for shallow boring diameters from 1.50 inches to 2.20 inches and a style for deep hole boring diameters from 1.60 inches to 2.60 inches. Four non-adjustable styles with

ARE YOU

WORKING OVERTIME TO KEEP YOUR PRODUCTION LINE FULL?

ARE YOU running more than one HACK OR BAND SAW?

Then you cannot afford to remain in the dark.

3 cuts - 6 finished ends.

with
WALLACE "CUT-MACHINING."



CHANGE MINUTES

Write! Learn how it's done.

WALLACE SUPPLIES MFG. CO.

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Chicago 13, Illinois

or Check Item 430

Cuts shown took

only 58 seconds!



throw-away inserts are also available for boring diameters from 13/4 to 3 inches.

For more data circle 69 on Postpaid Card

modern machine shop *

TAP CHUCK

The Model '09 tap chuck, released by Erickson Tool Company, 34358



View shows Erickson Model '09 Tap Chuck

Solon Rd., Solon, Ohio, combines the absolute concentricity inherent in

> Erickson Collet Chucks with a positive drive

device which completely eliminates

tap slippage, according to the

company. The compensating positive drive accommodates all sizes of taps within the range of the tap chuck. The driver consists of a slotted bar free to shift within the body of the tap chuck. Set screws at each end of the slotted bar grip the square shank of the tap in the

Milwaukee shop finds way to form products for 76 industries on single machine!



Here at Biersach and Niedermeyer, Milwaukee, U-channels are being formed at 400 per hour from 18 gauge steel. Tomorrow, on the same machine, they may be forming W-shaped fins from 24 gauge steel; or cylindrical motor housings holding close tolerances on roundness and end alignment; or any of hundreds of other products. Production runs are generally limited and, with this versatile press brake, Biersach and Niedermeyer has eliminated the need for expensive specialized machinery to produce the huge variety of products required by 76 separate industries. They quickly and easily set up the Pacific press brake to do virtually any job. Adjusting the stroke length by a six station micrometer depth stop, they form several different bends accurately from one die set. Write for brochure.

PACIFIC PRESSES & SHEARS

848-49TH AVE., OAKLAND, CALIF.: also MT. CARMEL, ILL.

For more data circle 431 on Postpaid Card

sign which is said to assure concentricity to within

slot. Thus, the tap

is held rigidly and

in perfect align-

ment with the

machine spindle

by the collet, but

positive drive is

provided by the

ploy the Erickson

double-angle de-

The collets em-

driver.

December, 1961

0.0005 inch TIR. The '09 tap chuck is available in three sizes: E09 accommodates taps from 0 to $\frac{1}{4}$ inch; F09 has a range of 0 to $\frac{7}{8}$ inch; and G09 has a range of $\frac{1}{2}$ to $\frac{1}{2}$ inches. The tap chucks are available with shanks for any types of spindles.

They are specifically recommended for lead-screw tapping and for applications involving precision tapping operations. A bushing-type collet is also available with the same compensating driver.

For more data circle 70 on Postpaid Card

MICROSCOPE

Bausch & Lomb, Inc., 83918 Bausch St., Rochester 2, N. Y., has announced a precision measuring instrument that provides a method which increases die life.

With the Die-Wear Microscope, the user can quickly determine the exact amount of metal which must be ground away to properly resharpen the cutting edge. It is important to maintain precise measurements, since each 0.001 inch of die metal produces

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More Shops Are Finding This Out

SPARTANIZED heat-treating gives a uniform hardness a bit different than others.

This results in faster, straighter cutting and more cuts per blade.



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Saf-T-Saws

These welded edge HIGH SPEED POWER BLADES are SHATTER-PROOF. Will stand extra tension and strain. They are doing outstanding jobs everywhere.

Teeth milled to exact size and shape, set evenly and accurately.

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SPRINGFIELD 7, MASS.

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HOLE SAWS • TOOL BITS • FLAT GROUND STEEL



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a certain number of stampings; the smallest amount ground away unnecessarily, reduces the life of the tool. Although compact in design, (it can either be hand-held or supported on its own base) the B&L Microscope is said to be capable of measuring diewear over a range of 0.020 inch to an accuracy of plus or minus 0.0005 inch or 10 percent of the depth, whichever is greater. The instrument can also be used for measuring bevels, burrs, and

The simplified operation of the Die-Wear Microscope is largely due to its unique design. Light in weight, it can easily be carried to the job. Awkward setups are eliminated and setup time reduced, since the microscope can be quickly positioned for measurement on the die. The base of the unit is easily

> removed when it is more convenient to hold the instrument by hand. A hardened and ground guide at the front of the instrument contacts the die edge to be measured. automatically positioning the microscope for best viewing. The guide can be used in holes as small as 3/32 inch in diameter or slots 3/16 inch wide, according to the company. The instrument may be purchased as a battery operated unit or with an accessory transformer for

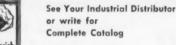


SIMPLIFY JIG AND FIXTURE DESIGN

LONG TRAVEL provides plenty of chip clearance, easy loading and unloading. Gets into hard-to-reach places. Base sizes: Model 2FL, 33/8" x 31/4"; Model 9FL, 43/8" x 35/8". Bar lengths from 8" to 18". Here are two examples of Grip-Masters speeding production in drilling and milling operations.









HEINRICH TOOLS INC., DEPT. 111-L

RACINE, WISCONSIN For more data circle 433 on Postpaid Card



Die-Wear Microscope

use where 115v, 60 cycle AC outlets are available. It is finished in a textured, durable nylon coating, making it easy to hold as well as to keep clean. For more data circle 71 on Postpaid Card

* modern machine shop *

BORING-FACING-GROOVING TOOL

Maxwell Industries, Inc., 493 East Fifth St., Ashtabula, Ohio, has an-

nounced the E-Z Set boring-facinggrooving tool. With only one setup, the head provides highprecision boring (adjustable to 0.0001 inch), facing, with rapidtraverse return, and grooving. The tool can also be used to produce counterbores, back counterbores, o.d. turning, chamfering and both i.d. and o.d. grooving.

As a boring head, the E-Z Set



Maxwell E-Z Set Boring-Facing-Grooving Tool

tool features an easy-to-read graduated dial around the entire body, providing direct reading in 0.001 inch. A large vernier permits adjustment to 0.0001 inch. In addition, the tool need not be locked during finish-boring cuts. Locking always moves the tool; when working in tenths any chance for accuracy is lost. The leadscrew and nut hold the tool tightly without creep, providing full accuracy of the adjustment, according to the company.

The tool is available in three sizes;



Permits individual bench or multiple-bench arrangement to requirements. Steel top, cabinet and four drawers. Drawers are 15¾" wide, 20" deep, 6¾" high. Available with pressed wood or hardwood top, if desired. 28" deep, 34" high and 60" or 72" long.

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MODERN MACHINE SHOP

185

the two smaller units provide 0.0025 i.p.r. facing feed and 0.100 rapid return; the largest provides 0.005 i.p.r. feed, 0.200 return. Feed and rapid traverse are accomplished without stopping or reversing the spindle. In addition, a positive stop is provided (and an overload clutch to eliminate damage to tool or work). Once the stop is positioned and locked, the tool

will repeat diameters precisely. To face, the upper of two collars is held by the hand; to return, the lower collar is held.

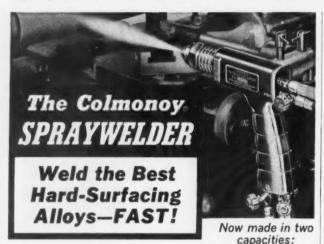
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* modern machine shop *

DRILL SPEEDER

Tapmatic Corporation, 845 West 16th St., Costa Mesa, Calif., has added the drill speeder Model No. 125 to its

line. This unit has a ratio of 6.25 to 1 and a capacity from No. 80 to 1/8 inch, according to the manufacturer. The Model No. 125 permits quick and easy installation on all types of drilling machines. Ball bearing precision delivers accuracy never before realized on drill speeder equipment. Simple and rugged construction of the speeders reduce maintenance to a minimum.



Spray on hard-surfacing alloys that fuse into long-wearing welded overlays. The Colmonoy Spraywelder applies highest quality nickel and cobalt base Colmonoy hard-surfacing alloys (eight grades). They produce abrasion and corrosion defying overlays that are uniform and

readily finished.

The Spraywelder applies metallizing coatings too. Use Colmonoy C-290 Powder(to rebuild crankshaft bearings) and other common metal powders.

MODEL D

High capacity of over 12 pounds per hour, at up to 95% efficiency.

MODEL F

Medium capacity of 7½ pounds per hour, at over 90% efficiency.

Ask for the Spraywelder Catalog

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Tapmatic Model No. 125 Drill Speeder

The Tapmatic Drill Speeders can be used in manual, semi or completely automated operations on all types of drilling machines. The company claims recommended spindle speeds of from 1200 to 3200 r.p.m. will produce maximum drilling speeds up to 20,000 r.p. m. Advantages of the units are said to include cleaner, more accurate holes; increased drill life; less drill breakage; greater production and fewer rejects. For more data circle 73 on Postpaid Card

* modern machine shop *



View shows Engis Talyvel Electronic Level

ELECTRONIC LEVEL

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill., has introduced the Talyvel Electronic Level, a precision instrument in which the standard bubble is replaced by a pendulum and a pair of variable inductance transducers which provide an electrical displacement signal. This signal is amplified to feed a center-zero meter. The Talyvel is battery operated. The transistorized amplifier and meter is scaled both in angular measure as well as linear to indicate precisely the amount of tilt of the Talyvel unit. The pointer comes to rest in about one second, according to the company.

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the MAGNI-FOCUSER helps insure accurate inspection of a precision part for an aircraft engine.



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matched prismatic lenses give needle-sharp magnification. Comfortably light weight. Fits over regular glasses. Leaves both hands free. Normal vision may be resumed by lifting head.

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Leaves both hands free to work

Magni-Focuser—the binocular magnifier—reduces eye-strain and prevents squinting—thereby speeding production, increasing accuracy and minimizing the chance of errors and accidents.

Gauge reading, layout work, inspection, tool and die work are just a few of the jobs that need the Magni-Focuser. Speeds precision assemblies, blue print work. Restores the usefulness of the skilled hands of many older workers whose vision needs a seeing aid.

Magni-Focuser can help your plant produce better. Immediate delivery. 10-day trial without obligation. Return to us if not satisfied, \$12,50.

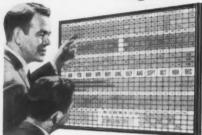
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Edroy Products Co.

Dept. P, 480 Lexington Ave. New York 17, N. Y.

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new equipment . . .

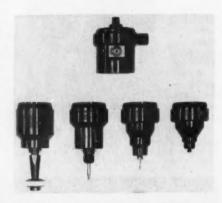
The Talyvel unit can be mounted inside an enclosure or on a high structure. The meter unit can be placed at a distance up to 300 feet from the level unit, where it can be conveniently seen and read. The Talyvel is particularly valuable for such applications as machine tool testing, releveling and adjustment, on launchers for missiles and rockets, for determination of sway of large structures and machine tool research. Two Taylvel units can be used for testing surfaces in two directions simultaneously. Also, the instrument lends itself to permanent installation in machines, buildings, bridges, structures and foundations to keep check on settling and shifting.

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★ modern machine shop ★

GRINDING UNITS

Two jig grinding attachments "300" Series and "5,000" Series have been added to the Vulcanaire line of Vulcan Tool Co., 730 Lorain Ave., Dayton, Ohio. Designed for grinding small holes with the proper surface feet per minute, the "300" Series has a speed



View shows Vulcan Jig Grinding Attachments

range of 215,000 to 300,000 r.p.m. and should be used on holes 0.020 to 0.090 inch in diameter. The "5000" Series, with a speed range of 100,000 to 175,000 r.p.m., should be used on holes 0.090 to 0.250 inch in diameter.

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* modern machine shop *

HYDRAULIC MOTOR

Cimtrol Div., Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has

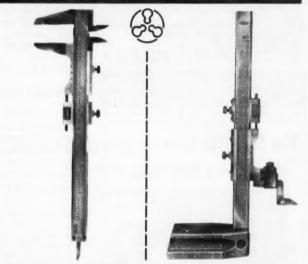
developed a unique 22 cubic inch hydraulic motor called the "Acradrive / 22." According to the company, the motor has a controlled speed range of 30-million to 1-from 500 r.p.m. down to 1/60,000 r.p.m. The motor is also extremely "stiff"; it has no backlash. It is claimed to have a high response rate: from 100 r.p.m. it will stop, reverse direction, and accelerate to 100 r.p.m. again all in 0.0015 second. When the motor receives a "stop"



"Acradrive / 22" Hydraulic Motor signal while turning at 100 r.p.m., it will rotate just 6 ten-thousandths of a revolution farther before coming quietly to a halt.

Biggest use to date is as a positioning motor on precision machine tools. A typical installation finds three of the motors driving longitudinal movement of the table and transverse and vertical movements of the spindle carrier on a Cincinnati bridge-type numerically controlled Profile and

MITUTOYO HIGH PRECISION TOOLS



PRICED TO GIVE EVERY MACHINIST HIS OWN TOOL

Vernier Calipers

Hardened stainless steel. Satin chrome finish and double length vernier for easy reading. Raised slides prevent wearing of graduations. 3 types available. With single set screw for fine adjustment (photo) \$16.00. Also available with spring thumb lock \$13.00.

8" Vernier Height Gauge

Hardened stainless steel – satin chrome finish. Designed with correct balance & weight, for exact alignment. Large vernier – horizontal scale for direct easy reading. Markings recessed to eliminate wear. Measuring range: 0" – 8". Price \$35.00 (also available in 12" at \$50.00).

Catalogue sent on request; ask your dealer or write: DEPT. 1

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December, 1961

MODERN MACHINE SHOP

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ard tool room needs. Also many new and ingenious items to speed up pro-duction and improve the appearance or efficiency of your product. All of highest quality and moderate prices.



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88 pages you are sure to find the latest in stand-

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ROTARY TABLES _ 5-8-12-15-18-24" sizes both standard and dial indexing types ADJUSTABLE TILTING TABLES_ #0-1-2 COMPOUND TABLES __ #1-11/2-2 ROTARY-COMPOUND TABLES ___ #1-11/2-2 INDEX CENTERS-multiple spindle SPECIAL MACHINES—designed and built

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new equipment . . .

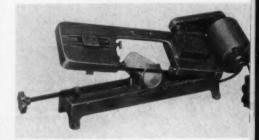
Contour Milling Machine. The motor has also been used in many Cincinnati specials.

The completed motor weighs 138 lb., and measures 121/2 by 6 inches deep. The company claims that its torque at full capacity is 3.52 in.-lb./p.s.i., with an efficiency of 98 percent. Although the motor can be used as a free motor. it is designed to be most useful under servo control. Because of its considerable torque, it can operate lead screws and drive shafts directly (closecoupled through the hollow spindle) and without any intermediate gearing to introduce backlash and rob efficiency, accuracy, and smoothness. For more data circle 76 on Postpaid Card

modern machine shop *

PORTABLE BAND SAW

A completely portable, horizontal metal-cutting band saw has been introduced by Griscer Industries, Inc., Garrett, Ind. Designated "Little G," the tool weighs only 42 pounds, including 1/4 h.p. motor, and may be used as an auxiliary equipment in the shop or taken to the job with equal ease. The tool uses a standard 1/2 inch by 0.020 inch by 59 inch blade, with accuracies said to be within 0.005 inch on a 3 inch cut. The rectangular capacity is



Griscer Portable Metal-Cutting Band Saw

3½ by 6 inches, diameters to 3½ inches, and angle cuts to 45 degrees on sizes up to 3½ by 3 inches.

The saw is said to need no tending as the cutting is automatic after the material is clamped into the positive-action vise. The cutting assembly is counterbalanced, eliminating the need for a hydraulic feed control. An automatic shut-off switch stops the motor when the cut is completed. Seven inch

diameter pulleys and blade guides, and adjustable takeup minimize blade breakage. A front bed extension is provided for facing operations. The bed size is 7 by 251/4 inches. The working parts are mounted on antifriction ball bearings and the 10 pitch worm gear drive operates in an oil bath.

For more data circle 77 on Postpaid Card

★ mms ★

GRINDING WHEEL

A three ply (type 28) hat wheel designated The Topper has



Bullard Topper Wheel

been introduced by the Geo. H. Bullard Co., Inc., Westboro, Mass. The Topper employs a bonded on 5/8-11 hub which is said to eliminate the need for special adaptor kits or assemblies.

The wheel features three layers of reinforcing fibre glass. The Topper assures smooth and easy cutting in less time, and insures long-life, according to the company. Designed especially for maximum effectiveness on high



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Fragile and miniature products of a metallic or non-metallic nature can now be located and held without distortion or surface marring.

Manufactured in our factory to precision tolerances and liquid honed upon completion, Morton Midgets are non-magnetic and also resistant to the corrosive action encountered with the use of welding or soldering fluxes and activated cutting fluids, Immediate delivery from our plant or any of our many distributors,

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December, 1961

MODERN MACHINE SHOP

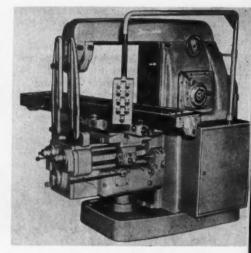
191

speed, air driven or electric portable grinders that operate at 5200 r.p.m. or more, Topper wheels are available in two sizes: 71/4 and 91/4 inches.

* modern machine shop *

DIAL TYPE PLAIN, UNIVERSAL AND VERTICAL MILLING MACHINES

S & S Machinery Co., 140-53rd St., Brooklyn 32, N. Y., has introduced the Supermill Dial Type Plain, Universal and Vertical Milling Machines, Models 2, 3, 4, 5 and 6. Features of the machines include directional centralized controls operating the longitudinal, transverse and vertical movements plus power in all three directions; all gears are of nickel chromed steel and are hardened and ground on



View shows S & S Supermill Milling Machine

Maag Series Precision Grinders; all shafts are hardened and ground and



For more data circle 443 on Postpaid Card
192 MODERN MACHINE SHOP



For more data circle 444 on Postpaid Card
December, 1961

are supported in high precision tapered and/or ball bearings; all castings are of a close grained, aged, grey iron and automatic lubrication is supplied to the column, saddle, table and knee, thus reducing excess friction and wear.

Latest innovations consisting of electric clutches and electro-magnetic brakes are now part of standard equipment as is separate motor drive to the knee. Design improvements of the machines include high range of

spindle speeds up to 1520 r.p.m. which are obtained through dial type speed selectors. Feeds are also selected through dial controls. Optional accessories include push button electronic penddant, motorized universal milling overarm, slotting, vertical milling and climb milling attachments.

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* mms

TAP THREAD

Besly - Welles Corp., 120 Dearborn, South Beloit, Ill., has introduced a controlled minor flat in Besly standard taps which is said to provide greater strength by eliminating the critical "vee" at the bottom of the thread form. This "vee" has here to



View shows Besly Standard Tap Thread Form

fore been a potential breaking point.

The thread form clears any hole drilled for 85 percent of thread or less.

This will include 95 percent of all tapping applications involving stand-





STANDARD Models

For Custom Dust Collection

A full range of job-tailored, standard DUSTKOPS — to serve single or multiple machine installations — is ready to answer your individual collection problem. Whether you're engaged in manufacturing, processing, converting or packaging, if air-borne particles are a factor, Aget has the answer — your answer.

DUSTKOPS are easier to install, save space, save money and are virtually trouble-free. Write for your copy of our free brochure to help you select the proper unit for your needs. No obligation, of course.

Also a complete line of mist collectors.

AGET

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ard stocked tools, according to the company. The tap chamfer is designed for immediate cutting, minimizing chipping and offers longer tool life. The stronger thread form is particularly beneficial in hand tool tapping such as that encountered by tool and die makers.

For more data circle 80 on Postpaid Card

INLINE AIR CONTROL VALVES

A straightway, Pacer solenoidoperated Headline has been added to the series of lightweight, inline air control valves offered by Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3, Mich. The unit combines a valve body with a solenoid pilot known for lightning speed. Both components conform to J.I.C. standards. The straightway has body and poppets

> of anodized aluminum alloy to reduce wear, corrosion and weight. The small, light, moving parts and short poppet travel assure rapid response with minimum impact energy and pressure drop. Synthetic rubber seals automatically compensate for wear.

The solenoid is rated for continuous duty operation at plus 5 percent or minus 15 percent of rated voltage for the standard air pressure service speci-



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INTRAMATIC

only the INTRAMATIC provides these revolutionary features in AUTOMATIC internal recessing

- 1. Capability for wide face or multiple-form grooves.
- 2. Deep grooving capabilities.
- 3. No limitations on groove position, regardless of remoteness from entry face.
- Back spotfacing to a maximum diameter of two times the hole diameter.
- Pilots directly in the part for employment with any machine tool without special fixturing—or may be furnished to accommodate employment in conjunction with existing drill jigs, etc.
- One basic Model "JA" will accommodate holes within the range of ¼".2" (with appropriate interchangeable pilots and cutters).

MODELS FOR LARGER AND SMALLER HOLE SIZES ALSO AVAILABLE

Let us quote to your requirements involving grooves for snap rings, "O" rings, thread reliefs, undercuts, back spotfacing, etc. Submit parts print marked to show tool entry and manufacturing outline showing all applicable dimensions at time of grooving.



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Air Control Valve

fication, according to the company. Other specs are: standard voltages, 115 and 230; standard frequency, 60 cycles, available in most AC and DC voltages, 25 through 60 cycles. Air pressures accommodated are: head, 30 to 150 p.s.i.g. and body, 5 to 150 p.s.i.g. The temperature range is from plus 40 degrees F. to plus 175 degrees F. Mounting is simple — either by through bolts or directly in the air line. For more data circle 81 on Postpaid Card

REACTOR CONTROL PACKAGE

Blue M Electric Co., 138th & Chatham St., Blue Island, Ill., has introduced the Power-O-Matic 60 saturable reactor which is said to operate without contacts, switches, moving parts, potentiometer sliders, photo cells and so on. Temperature characteristics of the reactor are: straightline, stepless, switchless, infinitely proportional wattage control; tempera-



tures consistently repeated throughout the entire unit range.

The complete one package reactor includes Power-O-Matic 60 control; saturable power reactor; voltmeter and circuit breaker plus heavy gauge polished aluminum ventilated housing: fused control circuit: range lock over-

Spin Your Rivets Faster



on the NOISELESS LINLEY RIVETER

Cut production costs with the Linley. Quickly pro-duces finely finished rivets. Takes rivets up to 3/8" in diameter in iron and cold rolled steel; even larger sizes in brass, aluminum and other soft metals. Send sample parts to be riveted and without abligation we will give you cost and time esti-mates of doing the jeb the easy Linley way.

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Blue M Saturable Power Reactor Control

temperature protection; power terminal for unit connection; and all wiring complete and enclosed. Range-Lock overtemperature protection guards workload and equipment and prevents damage from accidental change in set temperatures.

The company claims that major advantages of the reactor are: (1) minimal maintenance-no expendable components are utilized: (2) simplicity -no contacts, switches, moving parts or auxiliary devices to wear, burn or arc; (3) control accuracy - reliably close temperature tolerance maintained indefinitely and repeatedly; (4) stability - non-cycling proportional power input method of control; and

ROTARY BUSHINGS



The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work - or both.

Eliminates expensive tool construction - Reduces tool wear - Prevents seizure and pilot breakage -Especially adapted where precision is required. Write for full information and prices

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(5) safety-no arcing, built-in overtemperature protection and low-volt control circuit

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modern machine shop ★

DIAL INDICATOR GROOVE GAGE

A dial indicator groove gage has been introduced by the Adam Tool Co., 50 East Eleventh St., New York

3. N. Y., which is designed for production measurement of "O"-ring. snap-ring and similar internal grooves. A unique feature of the gage is a set of extension arms which enable the same gage and the same measuring tips to be used for grooves in deep bores and for grooves in shallow recesses.

In order to ensure efficiency in use, the weight of the gage has been minimized by a compact design and an aluminum body. For long wear and



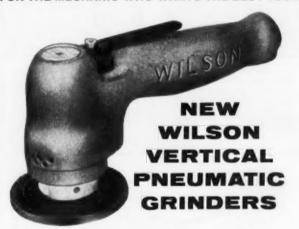
Adam Dial Indicator Groove Gage

for accuracy, the gaging tips and other critical parts are made from hardened and ground tool steel. The indicator is nested in and protected by the gage

Five standard gaging tips cover the range of "O"-rings from 6227.3 to 6227-52 and snap rings from 50 to 500. With extensions the gage can be used to measure grooves inside a bore 6 5/16 inches deep.

For more data circle 83 on Postpaid Card

FOR THE MECHANIC WHO WANTS THE BEST TOOL



Wilson Series 923 vertical grinders are excellent for flash removal, snagging, weld smoothing and other metal removing operations. These powerful grinders are particularly suited for metal removal in deep cavity molds and other hard-to-get-at places. Available in threaded spindle and collet chuck models.

All Wilson portable pneumatic production tools are lightweight, compact. • Catalog PT-58 gives all the facts. Write for your copy.

TW916

THOMAS C. WILSON, INC.

21-11 44th Avenue, Long Island City 1, New York BETTER TOOLS FOR BETTER WORK

For more data circle 450 on Postpaid Card

December, 1961

MODERN MACHINE SHOP

197

MINIATURE CARBIDE REAMERS

Two series of solid carbide, 4 flute reamers have been added to the extensive line of solid carbide tools by the Atrax Co., 240 Day St., Newington 11, Conn. Called "Micro" reamers, the miniature tools are available in Series 9164, 8 fractional sizes from 1/64 through ½ inch in diameter, and in

Miniature Solid Carbide "Micro" Reamers

Series 9158, decimal sizes ranging from 0.0151 through 0.115.

These are precision ground tools with reamer diameter tolerances of plus .0001 to plus .0003, according to the company. All reamers are 4 flute, straight flute with precision ground lands to assure uniform, precise hole

tolerance and long reamer life.

Recommended for all materials including steels up to Rockwell C-56. the Atrax "Micro" Reamers have been application tested on abrasive plastics, synthetics, fibers and exotic alloys. The company claims the tools can also be used for close tolerance reaming on electronics circuit board and instrumentation production.

For more data circle 84 on Postpaid Card * mms *

MAGNETIC CHUCK ACCESSORY

Homestrand Machine Tool Corp., 392 West Putnam Ave., Greenwich, Conn., has announced a surfacing plate which is an accessory for magnetic

PROGRESSIVE LIDO CUTTING TOOLS

BORING TOOLS

Solid, head, high speed and carbide tipped boring tools (standard and stubby) featuring round shanks with parallel flats for solid, three-point clamping. Bore sizes from 1/16" to 1-1/4".



BORING HEAD

Rugged, precision construction featuring dial screw (guaranteed for life) graduated for direct reading, interchangeable shanks, two boring bar holes, plus cross-hole, choice of 3/8" or 1/2" bar holder.



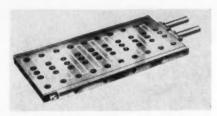
FLY BAR

Progressive step fly bar takes four small chips instead of one large chip with low-cost standard lathe tools. Reduces spindle vibration and wear. Tools easily free-hand sharpened. Complete literature on request.





For more data circle 451 on Postpaid Card



Homestrand Magnetic Chuck Accessory

chucks and is used where distortion caused by magnetism is a problem. It

features a number of plungers, which can be quickly set to support a workpiece so that it may be machined in its natural, undistorted state. When the chuck is turned off, the piece remains as machined.

For more data circle 85 on Postpaid Card * mms *

TUNGSTEN CARBIDE

Kennametal. Inc., 1 Lloyd Ave., Latrobe. Pa., has announced an ultra-high strength tungsten carbide which is being used to generate pressures of more than 1.000,000 pounds per square inch, according to the manufacturer. Anvils, dies. plungers, and backup plates ranging in diameters from one

inch to more than eight inches—are now being produced by Kennametal for use in the synthesis of diamonds, borazon, and other materials.

For more data circle 86 on Postpaid Card

* modern machine shop *

THREAD ROLLER

A planetary thread rolling machine designed for fast setup has been introduced by Prutton Corp., 5305 West 130th St., Cleveland 30, Ohio, The

ECONOMY SAW CUTS SHEET STOCK WITH 4-WAY ACTION



Accurate Squares up to 10 ft. Wide Any Length — Cuts Metal or Plastics

The new Ty-Sa-Man Economy "111-CX" produces accurate square rectangles up to any length, and up to 10 feet wide, from stock up to two inches thick. Motor and arbor travel on a transverse rail, which moves along two side rails. This four-way movement, in combination with the 90 degree swivel head, permits trimming all four sides of a plate without moving it. Handling time is reduced to a minimum.

Ty-Sa-Man

Write for FREE BULLETIN

TY-SA-MAN Machine Co., Inc.
1101 White Ave., Knoxville, Tenn.

For more data circle 452 on Postpaid Card

December, 1961 MODERN MACHINE SHOP

100

Prutton Model 75A thread rolls screws and nails at speeds of 400 pieces per minute according to the manufacturer. The machine handles over-all blank lengths up to 3 inches and diameters as large as 1/4 inch. Only two adjustments are needed to raise the entire feed finger and track assembly.



O-Ring & Snap Ring Grooves, Undercuts. **Thread Recesses**

ADAM TOOL CO.

Besigned Built 50 East 11th Street, New York 3, N. Y.

For more data circle 453 on Postpaid Card



For more data circle 454 on Postpaid Card



Prutton Model 75A Thread Rolling Machine

Special features of the machine are: rear loading during operation: cradled hopper with external drive free of obstructions; track mounted vibrator for peak efficiency; rapid adjusting feed track; expanding die mandrel for trueing die and small thin-wall ring die that can be set up in ten minutes. For more data circle 87 on Postpaid Card



blind screw holes-make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool mak-er's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench-no other tools needed. Get more work now-save money tool

HEIMANN MFG. CO. URBANA

For more data circle 455 on Postpaid Card

IN 11 SIZES-No. 6 to 1"

N.C. In all S.A.E. sizes.

OILER FOR COILED STOCK

A coiled stock oiler has been announced by Jaco Devices, Inc., 98 High St., Hingham, Mass. The Jaco Oiler introduces a new concept for cleaning and depositing a controlled film of cutting oil on the top and bottom surfaces of coiled stock before it enters the punch press dies. Oil is fed to the core of a pair of rollers and the flow is controlled to each roller by adjust-

able needle valves. Thus a uniform film of cutting oil is maintained. The stock is wiped clean by a pair of squeegees as it enters the oiler. The Jaco Oiler is capable of handling coiled stock up to 3 inches wide and 1/16 inch thick. Its oil supply is contained in a plastic hottle which can be refilled in seconds. Because there is no open reservoir, wasted cutting oil due to excess lubrication is eliminated.

For more data circle 88 on Postpaid Card



Jaco Stock Oiler

BORING MACHINE

The standard Model 772 precision boring machine recently built by Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich., features a setup developed to accept five different types of cylinder heads, in either 4- or 6cylinder versions, with a minimum of changeover time. Two of the five heads are processed at the left-hand end of the machine, while the remaining



(shown) MODEL AUD

11" swing. Fully universal. For complete indexing and spiral cutting. Spindle threaded 21/4"-10, 190 lbs.

Right or left hand types. Large tapered bearing adjusts for end play. Worm wheel and alloy stress-proof steel shaft can be fully disengaged. Ball bearing thrust on worm shaft and rear of spindle. Head tilts past 90°. Swivel base and rising blocks available. 3 index plates for dividing all numbers to 50, even numbers to 100 except 96T. Chart shows all divisions obtainable to 380.

Send for literature, giving dealer's name.

28 SOUTH ST. CLAIR STREET TOLEDO 4, OHIO Lathe and Magnetic Chucks

Milling Machine and Drill Press Vises

For more data circle 456 on Postpaid Card

three cylinder heads are machined at the right.

Taking the left-hand end as an example, the workpiece, a 4- or a 6cylinder component, is manually loaded and hydraulically clamped. The machine table rapids to the left and



W.J.SAVAGE COMPANY

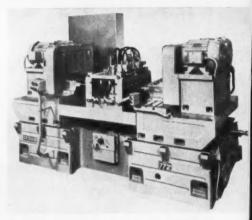
For more data circle 457 on Postpaid Card

ADJUSTABLE DRILL JIG

- eliminates layout
- cuts drilling time

Used for drilling holes through round stock and hex stock from \(\lambda''\) to 2" and cap screws from \(\lambda''\) to 1\(\lambda''\), the new Mathewson Adjustable Drill Jig eliminates layout and can cut drilling time on small lots to a fraction. And it eliminates the costs of special jigs for larger quantities. • Holes for cotter pins, set screws, drive pins for bayonet joints, oil holes in tubu-lar sections, and wiring holes in cap screws, are all typical of the operations that can be done more economically with this jig. Hole diameters range from .052" to .531", using your A.S.A. standard slip bushings. • The hardened V-block has two 60-degree V's for centering round or hexagonal stock, one for 1/4" to 21/32" diameter, one for 21/32" to 2" diameter. Adjustable stop for locating work longitudinally for drilling any distance from end, may be used on either side. Adjustable bushing carriers hold slip bushings and clamp work securely. • Jig highly successful in permitting use of inexperienced drill operators. For circular write to: Mathewson Machine Works, 40 Hancock St., Quincy 71, Mass.

For more data circle 458 on Postpaid Card | For more data circle 459 on Postpaid Card



Ex-Cell-O 772 Precision Boring Machine

the boring quills finish bore, counterbore and chamfer both intake and exhaust valve guide holes. When this machining is completed, the table rapids to the start position, the workpiece is repositioned and the cycle repeated to complete the machining on the remaining valve guide holes.

The Ex-Cell-O Precision Boring Machine is equipped with twelve boring spindles, six at each end. When a 4-cylinder head is to be machined. changeover from production of a 6cylinder head merely involves the removal of two of the boring quills. Finish bored holes are easily held within the specified limits of 0.001 inch variation on diameter and pro-



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duction of any type of head is said to be 23 parts per hour.

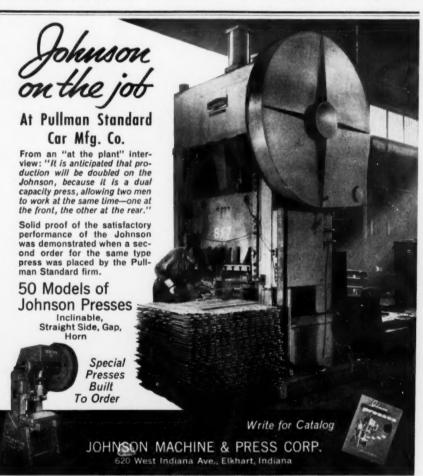
For more data circle 89 on Postpaid Card

* modern machine shop *

STAINLESS STEEL ALLOY

A low work-hardening stainless steel alloy developed for severe cold heading, swaging and other cold forming applications has been announced by Armco Steel Corp., 703 Curtis St., Middletown, Ohio. Designated Armco 18-9 LW, the material offers fabricating properties and corrosion resistance similar to that of Armco 16-18 stainless and other high-nickel alloys. Armco 18-9 LW is expected to be used for fasteners and related parts in automotive, aircraft, missile, chemical equipment and appliance applications where corrosion resistance is very important.

For more data circle 90 on Postpaid Card



For more data circle 460 on Postpaid Card



to anti-friction bearings...cuts maintenance and lubrication costs...increases production! Bearings, Inc. converts plain bearings

Many of our customers have realized considerable savings by converting to anti-friction bearings. Our bearing engineers recommend the best bearings for each type of application, design and supervise production of the special housings often required.

The result is a clean, economical conversion that is quickly installed and materially reduces maintenance and lubrica-

ting costs. Production, with better quality, is usually

overs from plain bearings to anti-friction bearings are a tion machinery. He may be able to suggest and recommend bearings that will increase production at lower cost. Change-Ask a BEARINGS, INC. engineer to survey your producspecialty with us.

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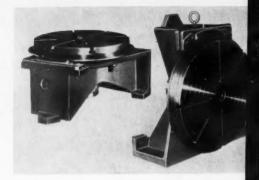
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MARYLAND: Baltimore • MISSOURI: Neiman Bearings Co., St. Louis • NEW JERSEY: Camden • Newark • NEW YORK: Balanrol Corp., Buffalo • OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield ARKANSAS: Little Rock . FLORIDA: Jacksonville . GEORGIA: Atlanta . Augusta . KENTUCKY: Louisville . LOUISIANA: Baton Rouge New Orleans • N. CAROLINA: Asheville • Charlotte • Greensboro • S. CAROLINA: Greenville • TENNESSEE: Chartanooga • Kingsport Knoxville . Memphis . Nashville . VIRGINIA: Norfolk . Richmond . Roanoke

For more data circle 461 on Postpaid Card

ROTARY ANGLE

A combination rotary table and angle plate that can be used either horizontally or vertically for a wide variety of inspection, layout and machining applications, has been announced by Machine Products Corp., 6771 E. McNichols Rd., Detroit 12. Mich. The free-wheeling face plate rotates 360 degrees with a radial accuracy by vernier, to 5 minutes visual reading. And for convenient readings in either horizontal or vertical position, graduations are on a 45 degree angle. The overall table diameter is 18 inches. The table flatness and runout is to 0.0002. Positioning rings and eight T slots are provided to facilitate loading and clamping parts. Two point table lock assures positive locking. A precision centering plug and sine bar arrangement for Jo block

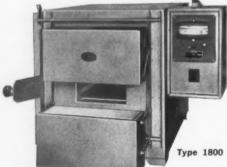


Machine Products Universal Rotary Angle

positioning is an optional feature of the rotary angle. The precisionscraped base features sturdy, ribbed construction. Ample hold down pads are provided to positively secure the unit in either horizontal or vertical positions.

For more data circle 91 on Postpaid Card

the new BIG bench-type furnace for heavy production heat-treating



An all-new TEMCO electric furnace specifically designed to let you heat-treat more and bigger parts in a bench-type unit. Larger chamber size . . 10° W, 9½° H, 22° D. Higher temperature range . . continuous up to 2000° and 2300° F (1095° and 1260° C) . . . handles most high-speed steels. This new Type 1800 TEMCO furnace features a close-sealing sectional door with patented lever suspension to provide limited or full access as desired. Reinforced welded steel case . . . 7½° firebrick and backup insulation. Choice of single or three-phase models, for 208, 230 or 460 volts. Available with or without controls. \$685 to \$745 furnace only.





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(formerly Thermo Electric Mfg. Co.) 488 Huff Street, Dubuque, lowa

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"FLYING CARPET"

"FLOATING AIR PLATFORM"
FOR JIGS AND FIXTURES

FLOATS THE WORK ON A FRICTIONLESS FILM OF AIR

Put one or more, depending on size, under a Jig or Fixture, and the loaded unit, weighing 25 to 1000 pounds, can be moved with a finger. Your machine operator won't be so tired so will AUTOMATICALLY work faster when loading a Jig or moving it from spindle to spindle. MORE PIECES ARE DONE PER HOUR. LESS WORK SPOILAGE, TOOLS line up with the bushings better, they don't chip, STAY SHARP LONGER. Comes ready to go to work, with valve, hose and fittings.

TRY ONE ON A 10-DAY, MONEY BACK GUARANTEE

The "Mighty Midget" Line

Makers of the "MIGHTY MIDGET" RADIUS & ANGLE DRESSERS.

SPERMAN METAL SPECIALTIES . 2199A E. 21st ST. . BROOKLYN 29, N. Y.

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COMMANDER
TAPPER handles
"IMPOSSIBLE"
tapping job

THE JOB: Tap 4 6-32 holes 11/16" deep in the hubs of production run, heat treated gears.

THE PROBLEM: Excessive breakage of the specially relieved taps used to handle the unusual depthodiameter tapping job . . spoiled parts . . high

costs. A number of different tappers were tried, but the problem remained.

THE SOLUTION: A Commander Tapper was installed . . . adjustable torque control set to protect the tap and job was resumed.

THE RESULT: 1700 pieces were tapped without breaking a single tap. Tolerances were held and a very high rate of production was maintained. This is typical of the performance a Commander Tapper can produce.

The extreme sensitivity, and wide range of adaptability of a Commander Tapper can be put to work for you; ask your nearby Commander Distributor for a demonstration.

WRITE FOR PRODUCTION TOOL CATALOG TODAY!

Commander MFG. CO.
4224 WEST KINZIE STREET • CHICAGO 24. ILLINOIS

For more data circle 464 on Postpaid Card

TURRET DRILLS WITH HOLLOW SPINDLES

Burgmaster Corp., 15001 South Figueroa St., Gardena, Calif., has announced that turret drilling, tapping, boring and milling machines are now available with hollow spindles for use with adjustable, preset toolholders and tools. The hollow spindle, accord-



Lima, Ohio For more data circle 465 on Postpaid Card





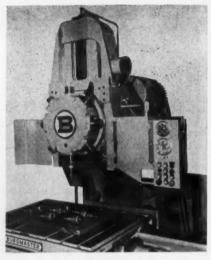
Accurate, rapid set-ups the first time, every time . . . is the reason Brookfield Tool Holders are now widely used in practically every metalworking plant in the cou try. With one Brookfield Tool Holder, you can cut your stack of bushings by at least 100. Here's why:

BROOKFIELD TOOL HOLDERS

holds wide range of tool diameters without bushings or accessories.	RANGE OF SIZES		
	MODEL NO:	HOLDING	SHANE DIA.
AXIALLY TRUE DESIGN	BA-10	1/4"-1/4"	36"
makes perfect tool alignment	DA-10	14"-14"	56"
	DA-12	14"-14"	34"
BALANCED-PRESSURE	GA-12	14"-14"	3/4"
maintains uniform seating, elim-	GA-16	14"-14"	344
inates creep or shift.	KA-16	14"-1"	1"
EAST TO USE - just slip tool	KA-24	34"-1"	11/4"
in the jaw, tighten, then float tool	PA-24	%"-1%"	33/4"
into dead center and lock.	PA-38	36"-136"	134"

WRITE FOR ILLUSTRATED CATALOG AND PRICES! BROOKFIELD, INCORPORATED

Distributors or representatives in principal cit LAIRD DE VOU, INC., CAMBRIDGE, MASS.



View of Buramaster 3BHT-L-3 Axis Tape Controlled Turret Drilling, Tapping and Boring Machine with hollow-keyed spindles.

ing to the company, greatly facilitates making setups for production runs. All tools in the run can be preset to length on the bench while the machine is operating, thereby minimizing down time for setup. When a tool becomes dull, it can be quickly replaced, reducing machine down time, thereby keeping the machine in more consistent operation on production runs.

Other advantages of the Burgmaster Hollow Spindles are: they reduce the amount of tool overhang and in-

JIG GRINDING and JIG BORING

to your specification

At your disposal: Our sub-contract |ig boring department, one of the best equipped in the

A. K. TOOL CO., INC.

Telephone: ADoms 2-7300 Digby 9-1445, N.Y.C.

For more data circle 466 on Postpaid Card For more data circle 467 on Postpaid Card

December, 1961



MACHINE KEYS



Our ability to furnish machine keys of every variety and from a wide range of materials is unsurpased. Standard gib head keys, ½" taper in 12", are carried in stock in C-1018 Carbon Steel. In addition we can furnish plain taper keys, straight keys, round end feather keys, tilt keys and many other varieties, upon request. All keys are made uniform to exacting tolerances. For your special needs we will gladly quote upon request. Send for new catalog giving complete information an Woodruff keys, taper pins, machine keys and geor rack.

STANDARD STEEL SPECIALTY CO.

Plants: Boover Falls, Pa.; Hammond, Ind.

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LEXCO HYDRAULIC LIFT TABLES

Capacities 500# to 2,000# STD. To 10,000# Special

Portable, adjustable height, Hand or Foot Operated. For lifting and transporting heavy castings, dies, etc., to machines and Presses.

Also DIE HANDLERS-STRIP STOCK HANDLERS

LEXCO ENGINEERING

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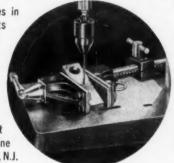
Souderton, Pa.

Instant change cuts production costs

AUTOMATIC KEYLESS CHUCK permits tool changes in seconds without stopping the spindle; prevents chewed-up shanks. One spindle does the work of many. The greater the torque, the tighter the grip.

DRILL PRESS VISE floats, and locks instantly, positively, in any position on the table. Holds work safely for accurate drilling and tapping. Three models: 8", 9" and 12" capacities.

Write for illustrated folder and name of nearest distributor to AMF Tool Division, American Machine & Foundry Company, 224 Glenwood Ave., Bloomfield, N.J.



WAHLSTROM®
AUTOMATIC CHUCKS

(Amf)

FLOAT-LOCK®

For more data circle 470 on Postpaid Card

crease the ability of tools to take heavier cuts with finer finish and greater accuracy by eliminating long tool sleeves. The amount of vertical turret travel is also reduced, which reflects itself in faster production. The Burgmaster Hollow Spindles are available as optional equipment at extra cost

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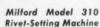
RIVET-SETTING MACHINE

A Model 310 single-spindle rivetsetting machine has been announced by The Milford Rivet & Machine Company, Milford, Conn., which handles semi-tubular rivets up to 3/16 inch in diameter and 1 inch long in heavy-duty, long-run production. A flexible cable has been provided with the standard mechanical clutch trip switch so that the foot trip can be

> conveniently located by the operator. In addition. the rotary hopper is fitted with a handwheel so that with a few turns the hopper barrel can be pulled quickly free for easy change-over to another rivet length.

Other major specifications of the Milford Model 310 rivetsetting ma-





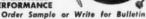


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KELM MFG. CO.

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MACHINE CLEANE

Cleans clogged T-slots \$1.95 . and brushes them away. \$19.50 Fastl Efficientl

per dez.

Convenient design, heavy duty construction . . . reduces machine cleaning "down time". Thousands in use. Order from dealers or direct. Send for literature. Dept. 12 Clean machines produce more and last longer

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save you man-hours

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- · Fast set-up, and easy blade changing
- · Air- and hydraulic-operated vises
- Automatic stock feeds for multiple bars

reduce your cost per-piece

- · Self-adjusts to fastest feeds
- Accuracy to .005"; angles to 45°
- · Shear-action stroke cuts maximum metal
- · Lift on return lengthens blade life
- Cut one or 1000 pieces . . . mild, alloy, and die steels; exotic and non-ferrous metals
- Choice of 2-, 4-, and 6-speed drives

dependable for long life

- · Oil-smooth hydraulic-powered feed
- Extra-large bearings . . . 90% self-lube
- · Require little adjusting
- · Product of 50 years' experience and continuous engineering improvements RS-118

Production and job-shop models, 6" x 6" to 24" x 24", wet or dry

Free information Write today for full details and name of nearby dealer, to:



Racine Hydraulics & Machinery, Inc.

Department M291, Racine, Wisconsin

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chine include: throat depth of 12 inches, anvil height averaging 42 inches, 10 inches diameter hopper, 72 inches overall height, single-revolution roller clutch, crank-driven toggle setting mechanism, 165 r.p.m, flywheel speed, V-belt drive and motor of 1/3 h.p., 1140 r.p.m., single-phase, 60cycle, 110 volts a.c. Extra raceways, which are available for sizes within the machine range, can be quickly interchanged by removing four bolts. Alignment is said to be positively controlled by keved construction which centers the raceway feed system with the machine driver spindle.

For more data circle 93 on Postpaid Card

TREPANNING TOOLS

A line of standard trepanning tools for the metalworking industry has



HORIZONTAL

VERTICAL

Full 1/3 h.n.

G. E. Motor

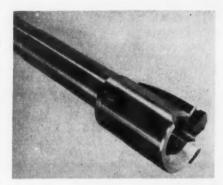
At last, a top quality industrial sander that provides all the most wanted \$89.95 features - yet sells for so little. complete-with cord, plug, switch ready to use

Work table in vert. illus. optional.

Illustrated Literature on Request A few desirable distributor territories still available

SALES CORPORATION 59-63 Van Dam 51. Brooklyn 22, N. Y.

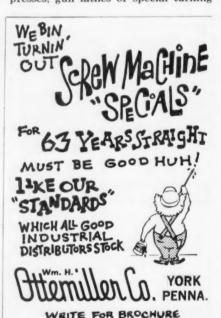
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View of Muskegon Standard Trepanning Tool

been introduced by Muskegon Tool Industries, Inc., Eleventh at Western, Muskegon, Mich.

Available in any diameters from 2 inches up, the tools will produce holes from the solid in one pass, and can be used on turret lathes, boring mills, drill presses, gun lathes or special turning



For more data circle 477 on Postpaid Card



INDEXING UNITS

High Accuracy Low Price

ELISHA PENNIMAN . ELMWOOD 10, CONN.

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Boost Production
... Up Profits

USE

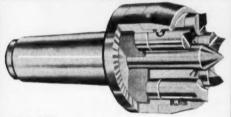
POWER GRIP

DRIVING CENTERS

on work held between centers

FOR

- Turning
- Hobbing
- Thread Milling



SAVE with these outstanding costreducing features—

- Shorter Set-Up Time
- Permits machining from end to end without change
- · Faster Loading and Unloading
- No Preliminary Machining of End Faces Necessary

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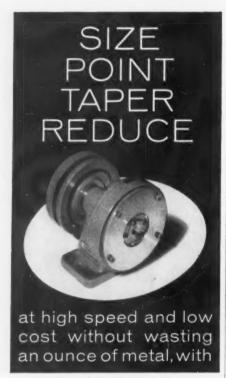
ROCKFALL, CONNECTICUT

ling Power Chucks • Chuck and Collet Actuators
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December, 1961

MODERN MACHINE SHOP

213



BENCH MODEL SWAGERS

Torrington Precision Swagers will save time, money and material in countless forming and assembly operations in your metalworking shop. Write for complete information on our full line of swaging machines - large and small.

> largest maker and user of rotary swaging machines

ROTARY SWAGING MACH

THE TORRINGTON COMPANY

Torrington, Connecticut For more data circle 482 on Postpaid Card new equipment . . .

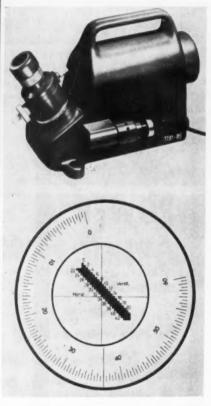
machines. They are available with i.d. or o.d. exhaust for use with or without coolant conductor, according to the manufacturer. Bits in high speed steel, carbide and tantung and pre-ground wear pads are also available.

For more data circle 94 on Postpaid Card

modern machine shop *

BIAXIAL AUTO-COLLIMATOR

Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y., is distributing the Leitz Biaxial Auto-Collimator.



View of Leitz Model Biaxial Auto-Collimator

214 MODERN MACHINE SHOP

December, 1961

HOLES FROM 1 SET UP With A POM 1 SET UP JOHANSSON RADIAL DRILL

Move the drill, not the work. Ram slides, rotates 360°, elevates.

Sensitive movements make it fast and easy to spot drill accurately over each hole location. Yet machine has rigidity of stationary drill when positive locks are engaged.

8 and 16 speed gear drive. Proper speeds instantly — change while machine is running.

Drilling	capacit	y													0		u	р	t	0	3"
Spindle	travel.			0			0				0	0			5	11	,	6	17	1	0"
Spindle	speeds.		R	a	r	g	įŧ	:5	1	fr	0	m	1	3	4		2	00	00	R	PM
Radial	Arm							*						*	2	1	/2	1	3	1,	4
Spindle	to Work		Si	u	f		1	M	le	1)	٤.	١.								. 5	4"



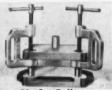
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PRESS ROOM
EQUIPMENT



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Combination Coil Cradles & Straighteners, 11 Mdls fr. \$2450

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TOOL COMPANY
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Write for new, free catalog detailing a complete selection of motor driven Scrap Choppers, Stock Reels, Coil Cradles, Stock Oilers and Roll Feeds...
Over 100 necessary pieces of equipment for the modern press room.

Our nearby
representatives will
be pleased to be
of service to you
without
obligation.



Wire Straighteners, 5 Models from \$160.



Standard Stock Straighteners, 13 Models from \$310.

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Many applications of the auto-collimator involve measurements in two axial planes. These are simplified by a new feature in the instrument, namely the diagonal direction of the minute scale in the ocular, which in itself consists of a series of angle patterns. On account of this novel arrangement there is only one measuring motion involved, which furnishes

the readings in both coordinates, without rotating the ocular or the telescope tube respectively. Since all readings—for minutes as well as halfseconds—are obtained within the same ocular without shift of the operator's eye, it is claimed that the speed and certainty of operation is increased several times.

The auto-collimator itself incorporates the same features of design as earlier Leitz models: compact cast-

> iron housing with handle, 20 inch folded beam, oversize aperture of lens and concealed hairline

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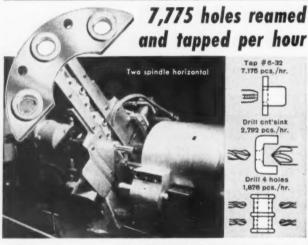
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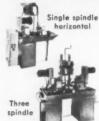
HOLE SAWS

Heller Tool Co., Newcomerstown, Ohio, has offered a complete line of hole saws ranging in diameter from 9/16 inch to 6 inches for cutting holes in steel, cast iron, stainless steel, alu-



View of Heller "Nuweld" Shatterproof Hole Saw





U-A MACHINES GUARANTEE LOWER PRODUCTION COSTS OF SECONDARY OPERATIONS

You bet it's a strong statement. Yet, here's what some of our users have told us.

"Our U-A machines save us so much time that we'll pay for this equipment in six months." "Really speeds up production and lowers

overhead."

"Exceeds our wildest production dreams."
Beat the high cost, low profit squeeze, use
U-A equipment. Before you "Do-it-Yourself"
we'll be happy to furnish a firm proposal for
cost comparison.

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DRESS CENTERS FAST-ECONOMICALLY WITH ABRASIVE CENT-R-LAP TOOL



Eliminates time and dust of diamond dressing • Removes scale • Laps without chatter. Sold in three sizes direct to consumer. Send for literature and prices.

J. R. REICH MFG. CO. P.O. BOX 2152 DAYTON 29, OHIO

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ROTARY MILL AND INDEX SPACES

Spacing in degrees
Uneven spacing
Milling kidney slots
Drilling bolt circles
Motorized power milling



M&M

tool & mfg. co.

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PAYS for ITSELF

NO MATERIAL LOSS

Continental PIPE AND TUBE Rotary Cut-Off Machine

It zips right through tubes from 38" to 114" O.D., from light gauge to 16-gauge wall thicknesses. Adjustable table with Tri-Roller Assemblies and Manual Stock Loader. Also Cutoff Machines up to 12" diam., air or handoperated.

Machine Rental Plan

Cuts up to 2,000 tubes per hour Continental

SINCE 1919

machine co.

2345 W. NELSON ST. . CHICAGO 18, ILL

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minum, copper, brass, wood, plastics and other machinable materials up to 11/2 inch thick. Heller "Nuweld" Shatterproof Hole Saws are said to combine high speed steel cutting edges electrically welded to tough alloy-steel blades: accurate rolling to diameter; silver soldered seams; permanent



For more data circle 490 on Postpaid Card



Soft-Blank Top Jaws are made to American Standards and may be used on any chuck having master jaws made to these specifications. All gre in stock and available for immediate delivery.

WRITE TODAY FOR SPECIFICATIONS AND PRICES

DEARBORN, MICHIGAN

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bonding to resilient steel cops; shoulderless design for deep cuts through stacked materials and knockout slots for easy removal of cores.

Complementing the Heller Hole Saw line are six arbors with straight hexagonal shanks, and pin drive in larger sizes, for a positive non-slip drive when used in jaw chucks and two high speed steel pilot drills with flat spots in shanks for equally positive drive

For more data circle 96 on Postpaid Card

modern machine shop *

PORTABLE AND SEMI-PORTABLE CONVEYORS

A complete line of fully portable. and semi-portable conveyors, with adjustable height, has been developed by The May-Fran Manufacturing Co., 1710 Clarkstone Rd., Cleveland 12, Ohio. The conveyors can be used as auxiliary or independent units to feed or discharge a wide variety of products.

The Series "A" Little Hustler is designed for conveying applications where working heights and layouts are frequently changed. It can handle small and medium size metal parts, including stampings, blanks, cut-offs, and so on. The conveyor is mounted on two swivel and two stationary casters. Construction of the conveyor is compact to permit passage through



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H G

HP-15

PRESSES FROM 2 to 50 TONS WRITE FOR CATALOG M-46

Greenerd ARBOR PRESS CO. A) CROWN ST. HASHUA . H.M.

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Troubled by Withdrawal Marks?

the new RELIEVOMATIC* saves you costly refinishing!

No more rejects or refinishing because of marred surfaces made by cutting tools on their return pass! Now-the RELIEVO-MATIC renders precise parts with perfectly smooth surfaces. For boring, turning or facing on automatic metal turning equipment.

Write for complete technical literature.





normal marred surface perfectly clear surface with RELIEVOMATICI

SILBER PRODUCTS, INC. 870 ESSEX STREET . BROOKLYN 8, N. Y. Nightingale 9-8600

For more data circle 494 on Postpaid Card December, 1961

TROYKE •

ROTARY TABLES

A Size and Model for Every Need



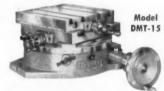
R-21

HORIZONTAL Sizes 9", 12", 15", 18", 21", 25"



Model U-15-4

HORIZONTAL and VERTICAL Sizes 9", 12", 15"



CROSS SLIDE ROTARY TABLE 12" x 12" Working Surface



CROSS SLIDE TABLE 12" x 12" Working Surface

Cross-slide accuracy: within .001" total in 10" of travel. Angular accuracy 60 seconds or less on all models.

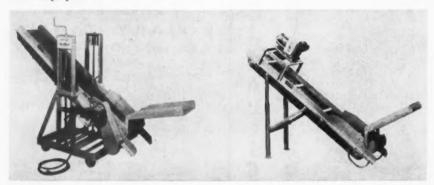
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"Rotary Tables Are Our Business"

TROYKE MFG. CO.

Cincinnati 41, Ohio

For more data circle 495 on Postpaid Card MODERN MACHINE SHOP 219



View shows (Left) May-Fran Series "A" fully portable and adjustable Little Hustler Conveyor and (Right) Series "S" semi-portable and adjustable Little Hustler Conveyor

narrow aisles and location in limited space. Heights of the charge and discharge ends of the conveyor can be quickly adjusted to any angle from horizontal to a 45-degree incline by means of a double-screw lift and crank handle.

A charging chute is included as

ELLIS DIVIDING HEADS...



BUILT FOR THE MOST CRITICAL

Whether the need is for extreme accuracy, adaptability for unconventional set-ups or exceptionally wide range of divisions, FLLIS fills the bill.

BUILT IN 3 SIZES 6½", 8" or 10" swing with exclusive floating index plate.

NICHOLS-MORRIS CORP. 76-H Mamaroneck Ave., White Plains, N. Y.

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LABOR SAVING **Production CHUCK**

Will pay for itself in 60 to 90 days

On turrets, engine lathes, cuttingoff machines, drill presses or any type of chucking machine, the Barker Two-Jaw or Three-Jaw hand operated chuck will increase production up to one third and actually pay for itself while doing it in from 60 to 90 days. Hand lever eliminates pneumatic and hydraulic systems, yet closes and locks iaws with lathe running or stopped. Over 30 years of labor saving,

CED



and locks while lathe is running.



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CHUCK DIVISION

THOMAS HOIST CO.

production boosting operation.

28 S. HOYNE . CHICAGO 12, ILL.

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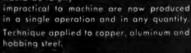
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HOBBING!

Here At Last!

Intricate Shaped Cavilies are Produced by Cold Extrusion to Precision Accur-





Lower cost-closer tolerances.

Send drawings of your designs for quotation to:

ANTON MACHINE WORKS

1226 FLUSHING AVE., BROOKLYN 37, N. Y.

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Tool and Cutter Grinder. The Relieving Fixture can be furnished with swivel index base, rectangular base, or extended base with outboard bearing and tail stock. Can be motorized or hand operated. Write for Descriptive Bulletin 161 and Fixture Prices, today



706 East 163rd Street . Cleveland 10, Ohio



For more data circle 499 on Postpaid Card

standard equipment. An optional swivel charging chute is available which allows feeding at any point within a 180 degree radius. Made of all-welded steel construction, the conveyor series is available with 4, 6, 8, 10, and 12-foot conveyor lengths. Belt widths of 12, 18, or 24 inches can be supplied.

The Series "S" Little Hustler, is a

semi-portable conveyor with telescopic legs (available in 13 sizes), that make it possible to raise or lower the discharge end to fit the application. This conveyor series is primarily designed for handling a straight run of a single material where a permanent conveyor installation is not practical. Available conveyor lengths and belt widths are the same as for the Series "A" Little Hustler. A charging chute with a positive trap is offered as standard equip-

ment. An optional swivel charging chute which permits feeding at any point within a 180-degree radius is also available.

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* mms *

MASTER LINK FOR SLING CHAINS

A drop forged master link, designated as Kuplink, for its line of Kuplex sling chains has been announced by American Chain Division, American Chain



Kuplex Sling Link





Write 7oday . . . for your copy of the new Johnson catalog. All models and accessories described, illustrated in full.

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222

make your mark...

Whatever your need for product marking may be, Hoggson stamps can meet it. They are made of finest alloy steel, heat-treated to stand continuous impact without breaking face or mushrooming body. Ask about our inspectors' symbol marking hammers, type holders, hand stamps with locating or positioning attachments, marking dies for hand and machine

HOGGSON
time-tested
STEEL STAMPS





HOGGSON & PETTIS MFG. CO., 20B Prindle Hill Rd., Orange, Conn.
For more data circle 501 on Postpaid Card



FAST SET-UPS — automatically compensates for misalignment up to 1/16'' on dia. between machine spindle and work.

Free-Floating, Easy-To-Use Ziegler Tool Holders permit machine operators to maintain production without scrappage due to alignment inaccuracies, eliminate bell-mouthed and oversize holes and keep job set-up costs to barest minimum.

PROMPT DELIVERY

SIZES and types to fit all machines used for tapping and reaming.



Hold positive hole location tolerances



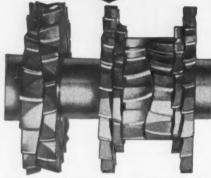
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W. M. ZIEGLER
ROLLER DRIVE FLOATING TOOL HOLDERS

13562 Auburn Detroit 23, Michigan

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By using the wide range of Standard ABER CUTTERS for gang milling... fast accurate cuts on any number of surfaces simultaneously.

ABER Engineering service will design and make the unit exactly suited to your job . . . send blueprints and specify material to be cut.

ABER Curved Tooth PLUS FEATURES

- 1. Longer production runs
- 2. More accurate control of limits and finish
- 3. Elimination of chatter
- 4. Faster heat dissipation
- 5. Shearing action

FREE DATA -

24 page catalog on milling with ABER Cutters.



ABER ENGINEERING WORKS

WATERFORD, WISCONSIN

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new equipment . . .

& Cable Co., Inc., York, Pa. The Kuplink combines the function of the master link and a coupler in one streamlined component. The need for the usual separate coupling device is eliminated as the coupler is an integral part of the master Kuplink. This means that when a load is set down a single leg sling can be withdrawn from under the load without snagging, according to the company. Master Kuplinks are drop-forged alloy steel, heat-treated and Magnaflux tested to assure maximum quality.

For more data circle 98 on Postpaid Card

* modern machine shop *

TRANSISTORIZED GAGES

A completely transistorized line of electronic gages said to be capable of measuring physical dimensions as small as two millionths of an inch has been introduced by Techni-Rite Electronics, Inc., 49 Centerville Rd., Warwick, R. I. The Minicom system of interchangeable precision measuring units includes two Minicom amplifiers,



View of Techni-Rite line of Electronic Gages

Get this Completely PALMGREN Illustrated

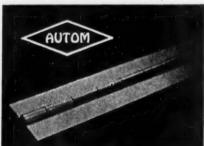


CATALOG #208

Drill press vises, angle vises, swivel machine vises, rotary tables, lathe milling attachments, production vises, heavy duty angle vises and adjustable angle plates are illustrated and fully described in this new Palmgren Catalog. 70 different models and types-vise jaws from 11/2" to 8".

PALMGREN PRODUCTS

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SPECIFICATIONS Open width 3/4" to 12" Gage Material .040" to .187" Pin Diameter .093" to 1/2"

AUTO MOULDING & MFG. CO.

Lengths to 144"

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CHICAGO 19

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504 Ways to Lick **Tough Finishing Problems**

FELT BOBS

18 sizes, seven shapes, four degrees of hardness -- a total of 504 Paramount Felt Bobs always ready to solve your most difficult precision finishing problems. Available with mandrels or unmounted. Finest quality wool felt.

Put a Paramount Bob on the Job

- For polishing surfaces that must be held to close tolerances.
- For buffing or lapping hard-to-reach
- For de-burring and touching up.
- For close-quarter precision finishing on all metal surfaces.

Get better finishes for less cost - "Put a bob on the job." See your Paramount jobber or write for literature. Ask about K-1 and K-2 Bob Assortment Kits that cost far less than buying bobs separately.

K-1 contains 66 pieces K-2 (K-1 plus 4 compound sticks) \$12.95

Bacon Felt Company 11 Fifth Street Taunton, Massachusetts

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MODERN MACHINE SHOP

225

a choice of Minicom height gages, bench comparators, Dice thickness gages, and the Minigage head. Small in size and light in weight, these units are said to be unequalled in accuracy, versatility, dependability and low cost. The units are available in both 110 volts a.c. or self-contained battery models

Also included is the Surfmaster for measuring surface roughness, the Delcom metrology comparator, the Pulcom cylindrical grinder control, and the Micro Checker for calibrating electrical and mechanical transducers.

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* modern machine shop *



An eight station turret chucking machine has been introduced by the



Logan Eight Station Turret Chucking Machine

Logan Engineering Co., 4901 West Lawrence Ave., Chicago 30, Ill. The eight station turret is mounted on

MONEY-BACK TRIAL OFFER Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

PREVENTS HEAT TREAT SCALE . . . up to 1500°F. Brush on, heat, brush off. All metals.

cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time . . . P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic water-soluble paste. Inorganic. Thin before applying and start welding at once. \$3.40 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of subassemblies. \$3.45 per gallon, f.o.b. Dayton.

PROTECT-O-METAL

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WHEELS & HANDLES









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NEW 1961 MODEL "SS"

Newly engineered and redesigned after 19 years of field testing. Convex, concave, or complex combination shopes are dressed quickly and easily by even inexperienced operators. Accuracy to .0002". Dresses all wheels up to 12"

cludes Diamond wheels diameter.

SOMERSET TOOL CO. 320 Virginia St. Hillside, N. J.

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write for free catalog on this high-speed radial

Here's a low-cost radial for modern high-speed drilling: 12 speeds up to 3200 rpm; spindle speed ratio of 40/1; automatic tapping reverse; adjustable spring counterbalance; hardened tang slot; safety elevating nut and screw; spindle mounted on 5 precision ball bearings; 9" column with 3' or 4' arms.

THE CINCINNATI GILBERT MACHINE TOOL COMPANY . CINCINNATI 23, OHIO

For more data circle 510 on Postpaid Card

SOLID CARBIDE CUT-OFF TOOLS



IN STOCK

Gashed, ready for use, in several widths for #00, 0 & 2 B&S machines. Same tool will cut either right or left hand. *Solid carbide cutting edge brazed to threaded steel center hub to eliminate breakage.

Get all the advantages of carbide:

Longer wear Less Gailing Better finish Higher speeds

Plus: up to 10 times the tool life of carbide tipped tools. Somma solid carbide cut off tools combine reasonable cost with long run savings by off the shelf delivery. Write for prices and name of your representative.

TOOL CO., INC. 120 SCOTT ROAD, WATERBURY, CONN.

West Coast Warehouse: 576 N. Frairie, Hawthorne, Cal. For more data circle 511 on Postpaid Card

precision, pre-loaded sealed ball bearing to assure accuracy and rigidity. The chucking machine features a precision headstock, precision spindle, flame hardened bed and ball bearing variable speed drive. It complements the complete Logan line of precision machine tools which include lathes, shapers and accessories.

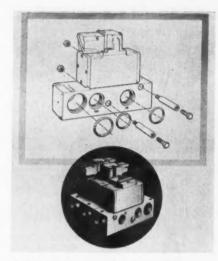
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* modern machine shop *

BASES FOR AIR VALVES

Hannifin Co., Dept. 166, 501 Wolf Rd., Des Plaines, Ill., has introduced "Add-A-Fold" bases for 3/6, 1/2 and 3/4 inch Hannifin Series "HH" Directional Air Control Valves which allow valves to be served by common air supply and electrical connections.

When equipped with "Add-A-Fold"



Add-A-Fold Bases for Series "HH" Air Valves

bases, Hannifin Series "HH" Air Valves may be bolted together in any



CENTERLESS GRINDING

Straight cylindrical, shoulder, profile and multiple diameter, internal and surface grinding of any material. Precision ground taper pins and straight dowel pins. Brown & Sharpe and Swiss Automatic aircraft and standard screw machine parts, heat treated and ground, if necessary. Light bench type production drilling. Prompt service. Send prints for estimates.

31 YEARS - SERVING INDUSTRY PORTER MACHINE CO., INC.

Mfgrs, of Por-Matic air operated drilling fixture. Drill bushings for same in stock. 3139 Enyart Ave. Cinti. 9, Ohio TR 1-4422

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BY A QUICK, EASY, INEXPENSIVE METHOD

Your business letterhead will bring literature.

WATTS BROS. TOOL WORKS

Wilmerding, Pa. For more data circle 514 on Postpaid Card



A matched set of transfer punches for toolmakers, machinists and tool cribs

Used for transferring location of threaded, drilled

and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel—Carefully heat treated and tempered for long life—.0025 undersize to facilitate use—Black oxide finish.

SET #3-17; 28 punches with indexed stand—sizes $\frac{1}{32}$ " to $\frac{1}{2}$ ", by $\frac{1}{44}$ "—plus handy $\frac{1}{22}$ " size. Length $\frac{4}{8}$ ". ONLY \$19.40. Single sizes available

R. L. SPELLMAN CO. • URBANA, OHIO

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UNIQUE FEATURES

- · Extended nose spindle . . . carbide tipped
- Life-time lubricated, pre-loaded ABEC-7 ball bearings
- Spring compensation to .020" axial movement without impairing accuracy
- Heat treated, stainless steel construction
- Hexagonal anti-roll shoulder

Vee-Arc Super-Precision Live Centers are also

AVAILABLE THROUGH YOUR MONARCH AND CINCINNATI LATHE DISTRIBUTORS

WRITE FOR BULLETIN 1282A DIRECT TO

VEE-ARC CORPORATION, DEPT. MM, WESTBORO, MASS., U.S.A.

For more data circle 516 on Postpaid Card

December, 1961

MODERN MACHINE SHOP



NEW LINCOLN 225-AMP WELDER PERFECT FOR SMALL SHOP!

Here's a welder that can save time and earn dollars for you. With it you can do just about everything—weld mild and stainless steels, cast iron; braze; solder; thaw frozen pipes; hardsurface. Full 225-amp output lets you handle large %" electrodes, big jobs, fast. It helps you hustle work through your shop quickly and efficiently.

Only Lincoln makes this welder which sells for less than \$200 and which will burn 3%" electrodes. Costs less than many 180-amp welders.

100-amp weiders

WANT DETAILS?
Send for new bulletin
No. 4610.1. Describes
machine and accessories, production and
repair uses. Write today. The Lincoln
Electric Company,
Dept. 2451, Cleveland
17. Ohio.





The World's Largest Manufacturer of Arc Welding Equipment and Electrodes For more data circle 517 on Postpaid Card

new equipment . . .

combination of actuations and mounted on 31% inch centers. Air supply, exhaust and electrical passages are tapped from both side of each base to permit the common connections to be attached at either side of the group. Grooves for O-ring gasketing are provided to assure leak-proof connections between bases.

The electrical junction box is built into the "Add-A-Fold" base making it unnecessary to disturb air or electrical connections to the valve after it is installed. Cylinder ports are located in the end opposite the electrical junction box.

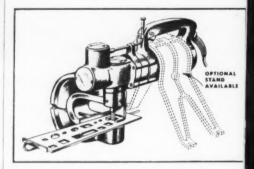
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* modern machine shop *

PORTABLE PUNCH PRESS

Modern Manufacturing Company, Inc., 680 Davisville Rd., Willow Grove, Pa., has introduced a portable punch press known as the Porta-Press that is said to exert 6,000 pounds but only weighs 17 pounds. Punch and dies can be easily replaced to punch out round, square, rectangular or any shape hole up to $\frac{7}{8}$ inch in diameter, up to $\frac{3}{16}$ inch thick aluminum and $\frac{1}{8}$ inch steel.

The Porta-Press can be carried to



Modern Manufacturing Portable Punch Press



GEARS

In Stock — Immediate Delivery

Gears, speed reducers, sprockets, thrust bearings, flexible couplings, pulleys, etc. A complete line is carried in our Chicago stock. Can also quote on special gears of any kind. Send in your blueprints and inquiries.

Send for Complete Catalog No. 20
CHICAGO GEAR WORKS

CHICAGO GEAR WORKS
440-50 N. Oakley Blvd., Chicago 12, III.

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COOK

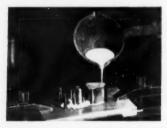
Now you can obtain non-marring Lead hammers — Hammer handles — Make 'em yourself — Production and Ladle Molds. Free folder — ask about our Remelt allowance service. COMPLETE LEAD HAMMER SERVICE

ALL AT LOW LOCAL PRICES
COOK'S LEAD HAMMER SERV.—E. PROV. 14, R.I.
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CERROTECHNICS saues TIME & MONEY

in Anchoring Punches in Punch Plates



CERRROTECHNICS — the technology of using CERRO* ALLOYS to expedite industrial operations.

Guided by die plate, punches are located in oversize holes in punch plate. Cap screws inserted into punch bases through auxiliary plate hold punches while CERROMATRIX is poured. Cuts cost 50% to 90%. Send for full information. "T.M. Cerro Corp.

CERRO SALES CORPORATION

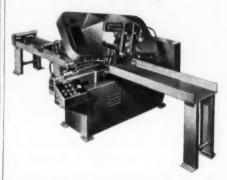
SUBSIDIARY OF CERRO CORPORATION
Room 1501, 300 Park Ave., New York 22, N. Y.

For more data circle 520 on Postpaid Card

December, 1961



Production Sawing Accuracy



to \pm .003" length and .002" of depth of cut runout squareness

The Peerless Saw provides industry with a rugged production saw which has no peer in the field today. Not only does it provide a fully automatic operation at high production speed for sawing billets, bars and structural shapes, but the Peerless Model 1200 can be used selectively as a power pullup conveyor—all with a length accuracy to ± .003".



PEERLESS MACHINE CO. Oshkosh, Wisconsin

For more data circle 521 on Postpaid Card

MODERN MACHINE SHOP

231

the job or be used on assembly: extensively used in air conditioning, metal fabrication and general production lines, according to the company. For more data circle 102 on Postpaid Card

modern machine shop *

VACUUM-ATMOSPHERE FURNACE

A high-temperature vacuum-atmosphere furnace has been added to the line of versatile electric laboratory and industrial production furnaces and ovens manufactured by K. H. Huppert Co., Dept. MO-3, 6841 Cottage Grove Ave., Chicago 37, Ill. The furnace was designed for a maximum operating temperature of 2000 degrees F. at 29 inch Hg, vacuum-with an inert atmosphere containing a small percentage of hydrogen to provide a slightly reducing condition. The clear work



View of Huppert Vacuum-Atmosphere Furnace

space is 12 by 12 by 20 inches, Alloy radiation shields are provided for insulation and the outer chamber is water-cooled. The heating elements



DURANT TOOL COMPANY

17 THURBERS AVENUE, PROVIDENCE 5, RHODE ISLAND

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SUPERIOR® INDICATOR

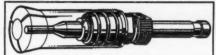
An accurate indicator at a sensible price. Double faced. Reads front and back.

Superior Indicator #75X with Universal Swivel...\$11.70

Superior Magnetic Base #4A Less Universal Swivel....\$5.00

SUPERIOR INDICATOR CO. P. O. Box 734, Rochester 3, N. Y.

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NEW! Self-Centering 5C Collet Stop

Quick friction adjustment. Stays in fixed position. Will not distort collet. Will not move back. Also available for other collets and spindles. 30 days Free Trial. Several Territories Open for Distributors.

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DRILL HARDENED STEELS WITHOUT ANNEALING -



With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon - high chrome steels of any degree of hardness. "HARDSTEEL" Drills fit standard drill presses. They save time and reduce

rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly, Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" Drills are cutting costs in thousands of plants.

BLACK DRILL COMPANY, INC.

13. East 222nd Street * Cleveland 17, Ohio

YOU HARDEN IT --WE'LL DRILL IT WITH -- "HARDSTEEL"

For more data circle 526 on Postpaid Card

are made of 1/4 inch Kanthal rod.

The vacuum pump, pump controls, power transformer and control instrument is located in the base of the furnace, providing compact unitized construction. The Huppert Vacuum-Atmosphere Furnaces are factory-assembled, wired and tested, ready for installation. The versatile design of the

vacuum-atmosphere furnace lends itself to a wide variety of applications. The furnace can be provided with various work chamber sizes and lower vacuums upon request. For more data circle 103 on Postpaid Card

* modern machine shop *

PROGRAM AUTOMATICALLY GENERATES POSITIONING INSTRUCTIONS

A program which enables an intermediate-sized computer to generate the instructions that prepare tapes for point-to-point numerically controlled machine tools has been developed jointly by Pratt & Whitney Co. and International Business Machines Corp., 112 East Post Rd., White Plains, N. Y. It requires only a basic configuration of the widely-accepted 1BM 1401, Solid State Computer.

Users of the program provide only a brief description—with simple numerical statements—of the locations in the workpiece to be drilled. The computer then calculates the positioning operations to be performed by the tool.

This information, plus other vital data such as tool changes and type of tool to be used, is fed to the 1401. The computer, under control of the program, produces the instructions that serve to position the workpiece for each operation.

These instructions, produced by the



OPTICAL PYROMETERS

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PYROMETER INSTRUMENT CO., INC. Bergenfield 42, New Jersey

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with PYRO

Accurate Hole Transfer Made Easy With NIELSEN TRANSFER SCREWS

Simply insert in holes, invert, strike sharply and you have centers and drill



circles perfectly located. Reduce time and eliminate spoilage of other methods. 8 sizes, from 1/6" to 3/4" U. S. S. Inexpensive—Last for years.

Write for Circular NIELSEN TOOL & DIE COMPANY 17336 Lahser Road Near Grand River Detroit 19, Michigan

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For more data circle 532 on Postpaid Card

December, 1961



When you dress grinding wheels regularly you clean loaded pores, uncover fresh abrasive grains -**GET NEW PERFORMANCE AGAIN** AND AGAIN. Dressing makes every wheel more efficient. In the complete Desmond line there is a dresser to meet your requirement-at low cost. A typical Desmond-Huntington dresser* costs less than \$3.00: replaceable cutter sets average 36c. Ask your Desmond distributor's advice.

The only complete line of grinding wheel dressers and cutters

Desmond-Stephan Mfg. Co. Urbana, Ohio

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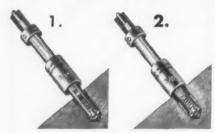
MODERN MACHINE SHOP

235

A Specialized Tap Extracting Tool

that will stop small cost leaks in your shop

How much time do you waste removing broken taps? How many expensive parts are damaged or scrapped? Much of this time, and the parts, can be salvaged with Walton Tap Extractors.



- The extractor's sturdy, heat treated steel fingers slip into the flutes of the broken tap.
- The extractor is pushed down until it touches the broken tap, and the sleeve placed firmly in contact with the work.
- With a tap wrench (not shown) applied to the square end of the extractor, the broken tap is simply, easily backed out.

No annealing or drilling. The broken tap is removed without delay . . . and without damaging the threads. Furnished for machine screw and hand taps, pipe taps, and Helical Coil "STI" taps in all standard flute styles for sizes #4 to $1\frac{1}{2}$ ". Try them at our expense in your shop (free trial).



For more data circle 534 on Postpaid Card
236 MODERN MACHINE SHOP

new equipment . . .

1401 in punched-card form, are then converted to perforated tape for input to a machine control unit, which numerically controls the operation of the machine tool.

The coding of instructions produced by the computer conforms to standards established by the Electronic Industries Association for numerically-controlled point-to-point machine tools guided by eight-channel perforated tape. Thus the program can be used—with slight modifications—with any combination of control unit and drilling machine that meets these standards.

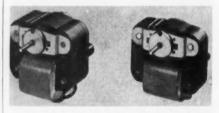
For more data circle 104 on Postpaid Card

* modern machine shop *

NON-GEARED MOTOR

A small unidirectional non-geared motor has been announced by Barber-Colman Co., 64 Loomis St., Rockford, Ill, with approximate dimensions of only 2.5 inches by 2.25 inches. The YAA sizes offer ratings to 0.005 h.p., no load speed of 3000 to 3300 r.p.m., starting torques to 0.19 lb.-in., alignable sleeve bearings and various mounting arrangements. Typical applications are fans for deodorizers and electronic equipment, blowers, reroll chart drives, phonographs, gear trains, electric erasers, and others, where physical size must be kept at an absolute minimum.

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View of Unidirectional non-geared YAA Motor

DEVICE FOR PRESETTING CUTTING TOOLS

Stocker & Yale, Inc., 150 Green St., Marblehead, Mass., has announced a new model Tool Analyzer which provides a quick and highly-accurate method of presetting tools for use in automated equipment. Also, it can be used in checking complete cutting geometry of small tools. The company states that costly down-time can be

avoided by quickly and accurately presetting cutting tools with the Tool Analyzer. This is particularly important in gaining maximum utilization automated machines. Diameters, depths, and proper tool location can be set to 0.0001 inch accuracies

An advantage of the Tool Analyzer is its ability to check cutting tool geometry at the same time that the tool is being preset. In addition, the Tool Analyzer can be used as a quality control instrument to assure that the tool conforms to specifications set up in the numerically controlled program. Some of the tool design elements that can be measured with the Tool Analyzer

include: hook or rake angles in flutes and spiral points; indexing of cutting edges; concentricity and thickness of web; chamfer angle, relief and length; thread form and relief; flank angles; lead; comparison of surface finish; major and minor diameters; pitch diameter; web thickness; width of lands/flutes; included point angles.

The Tool Analyzer consists of a solid base which supports a highlyprecision spindle or riser blocks con-

FREE REPRINTS

The following reprints are available free of charge in limited quantities upon letterhead request to this magazine:

"Aerodex Keeps Them Flying"

"Automatic Tracing Speeds Mold Production"

"Cold Extruding Steel Alloys to Precision"

"Causes and Cures of Heat Treating Distortions in Tools and Dies"

"Crankshaft Repair"

"Facts You Should Know About Cutting Fluids"

"Hobbing Automatic Transmission Shafts"

"Hogging-A Job Shop Specialty"

"How Thorough Is Your V-Belt Maintenance?"

"Let's Discuss Numerical Control in Simple Language"

"Milling Applications Unlimited"

"Portable Radiant Heater Simplifies Hot Forming Work"

"Special Tooling Extends Use of Induction Heaters"

"Sub-Zeroing Improves Pinion Performance"

"Welder Manufacturer Reverses Import Trend"

"The Supervisor and His Boss"

modern machine shop

431 Main St., Cincinnati 2, Ohio

taining ground and centered V-blocks. The ability to interchange the spindle for V-blocks, or vice versa, affords greater capacity without sacrificing accuracy. Through the use of adaptors, all types of shanks can be accommodated. The measuring principle incorporates a monocular, zero-paralax



Bulletin 360.

2361 University Ave., St. Paul 14A, Minnesota
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Grind 1/8"-21/2" Drills on 1 Drill Grinder



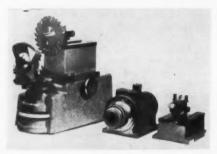
STERLING "DF" Drill Grinder

Grinds accurate clearance angles with built-in gauge. Positive centering, diamond wheel dresser produces long lasting, accurate drills. For details write for Bulletin "DF" Today.

McDONOUGH MFG. CO.

1521 Galloway, Eau Claire, Wisconsin

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View of Stocker & Yale Tool Analyzer (Left) with riser block, Vee block and cutting tool in position; (Center) spindle equipped with chuck and collet and (Right) riser with Vee block and cutting tool in position.

optical system which is said to provide accuracies to 0.0001 inch. Interchangeable reticles are available as an accessory. The tool to be inspected is checked in the same position as it would be used in the machine and all readings are made in one setting.

For more data circle 106 on Postpaid Card

* modern machine shop *

GLASS MOULD REPAIR POWDER FOR SPRAY BRAZING TORCH APPLICATION

A metal powder for repairing of glass moulds using spray type brazing torch equipment has been introduced by Wall Colmonoy Corp., 19345 John R Street, Detroit 3, Mich. Designated

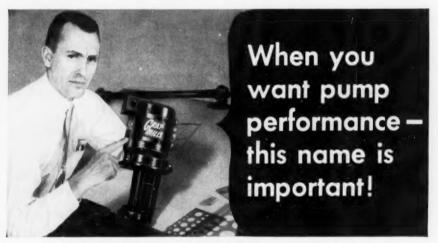
More Information?

For additional information on any product mentioned in this issue, please use the READER SERVICE CARDS opposite pages 32 and 268. Colmonoy No. 21 Sprayweld Powder, the material can be easily formed and finished with a file. Especially developed for use with brazing torch equipment, Colmonoy No. 21 powder requires no special skill for application.

The powder is recommended for repair of nicks, cracks or chips in mould edges, match lines and other critical mould surfaces. As deposited, it produces a consistent and uniform

hardness, according to the manufacturer. No hard spots are said to develop in the Colmonoy No. 21 overlay. All overlay areas are readily filed for easy finishing to size, shape and desired smoothness. Colmonoy No. 21 is a nickel base hard-surfacing powder. As deposited it produces a uniform hardness of approximately 28 on the Rockwell C scale.

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GRAYMILLS Superflo

Thousands of GRAYMILLS Centrifugal Superflo Pumps have been installed as original equipment; and thousands more are in use as conversion or replacement units. In addition to continuous use for pumping coolants, they've been used to pump abrasive slurries, ground glass, lens polishing rouge, enamels, lacquers and degreasing solvents. Over millions of hours of operation, the name GRAYMILLS has become synonymous with pumping performance. Available in 36 standard models completely interchangeable with other makes. Don't replace trouble with trouble . . . put a GRAYMILLS Coolant Pump on your machine and relax! They're sold by leading industrial distributors everywhere. Write for complete catalog—No. 56R



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December, 1961

MODERN MACHINE SHOP

239

RADIAL DRILL PRESSES

A line of Delta ram-type radial drill presses has been introduced by Rockwell Manufacturing Co., Power Tool Div., 606G N. Lexington Ave., Pittsburgh 8, Pa. The radial drill presses cut production costs and simplify production operations, according to Rockwell, by making it unnecessary to

move jigs and other mounting fixtures. Eight models are available with either $4\frac{1}{4}$ -inch or 6-inch spindle travel and "standard" 30-inch or "long" 42-inch column length.

Because the spindle can be moved to the work, the tool is said to provide unusual versatility. The drill press head moves in and out through an 18-inch travel radius on a smooth traveling ram that permits drilling to the center of a 62-inch circle. Head,

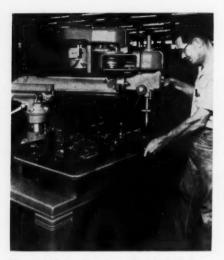
ram and cradle swivel a full 360 degrees around the column to permit drilling anywhere on the table or on work that must be kept on the floor. (The table has 4 T-slots and an oil trough tapped to accommodate coolant piping.) The head tilts 45 degrees and locks on both sides to prevent angle deviation under heavy loads. The head can be raised and lowered rapidly. A built-in ball bearing jack shaft assembly provides 16 full-power speeds ranging from 175 to 8200 r.p.m, with 1725 r.p.m. motor. Sanding drums, tapping heads. chip breakers, multiple drills, mortising attachments and most other attachments used on standard drill presses can



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7N023 YORK RD., BENSENVILLE, ILL.

immediate delivery.



View of Delta Ram-Type Radial Drill Press

be readily used on the machines.

These characteristics are said to make the drill press ideal for rapid

precision drilling of large or heavy stock, sheet stock, panels or plywood since several widely separated holes can be drilled without moving the work, accoording to the company. Machine-tool ruggedness and long life are provided by a massive 26-by-18-inch cast iron table, one-piece head and ball-bearing construction which enables the ram to roll effortlessly on eight precision ball bearings mounted in a rugged supporting cradle. A ball thrust bearing on the column support collar facilitates swinging of head, ram and cradle.

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★ modern machine shop ★

RESINOID BONDING METHOD FOR DIAMOND WHEELS

The Precision Diamond Tool Company, Box 274A, Elgin, Illinois, announces a new resinoid bonding method for diamond wheels. Said to give much longer life to a resinoid bonded wheel, it is especially adaptable for

LOWEST INITIAL COST LONGEST LIFE...

WITH AMAZING NEW VACUUM DIAMOND BOND

Revolutionary process actually preserves diamond lower stress. Write for free brochure and price sheets. Explains tremendous benefits. Specialists for coned diamond tools and shaped tools.



CARAT	1/4	3/8	1/2	3/4	1	11/4	1 1/2	2	
PRICE	2.75	3.50	5.00	7.25	10.00	12.80	14.80	23.00	

SPECIAL OFFER: Reject thread grinder diamonds 1/4" x 1" \$1.75 each in lots of 6 pcs.

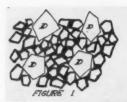
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tool and cutter grinding. Pronounced and impressive savings have been effected in grinding and re-grinding tungsten carbide tools of all kinds. The secret of increased life and cutting action lies in the fact that the manufacturer, through molecular research, has succeeded in developing a resinoid bond that actually chemically attaches



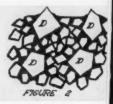


Fig. 1-Ordinary bond. Fig. 2-New bond.

itself to the diamond. Heretofore resinoid bonds merely locked the dia-

mond in place and acted as a holding socket. Figure 1 of the accompanying illustration shows ordinary resin bond while Figure 2 shows the chemical adhesion of the new type "BH" bond. By actual attachment to the cutting crystal, the diamond is firmly held until every bit of cutting life is extracted from it. For more data circle 109 on Postpaid Card



You can get more out of radial drills if you use standard Scully-Jones tools in "special combinations." For example: A "Safe-Torque" driver with quick-change collet combines fast tool changing with breakage-free tapping. In the same combination, you could add a close-center tap driver and avoid the expense of special length taps. The S-J drill stop controls hole depth and incorporates quick-change features of its own . . . as does the S-J heavy-duty tap holder. It is not uncommon to see four standard S-J tools used simultaneously in plants which demand high efficiency.



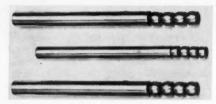
Scully-Jones and Company

1909 South Rockwell Street, Chicago 8, Illinois
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BALL MANDRELS

m m s

Bends as critical as 1-D can now be made without wrinkles, in ½ inch to 6 inch tubes in a ball and socket mandrel according to the manufacturer, Continental Machine Co., 2345 W. Nel-



View of Continental Ball and Socket Mandrels

son St., Chicago 18, Ill. High yield strengths: 1 inch—11,000 lb.; $1\frac{1}{2}$ inches — 25.000

Inches = 25,000
Ib.; 2 inches = 45,000 Ib.; 3 inches = 100,000
Ib. and 4 inches = 180,000 Ib. are said to make the mandrels suitable for compound and tangent bends in tubes in which only 2-D or 3-D bends could be achieved previously.

Pitch length between sockets is one half or less than mandrel diameter. Precision wiping action of the balls assures a smooth bend when mandrel is removed. Ball detents keep mandrel perfectly aligned permitting high production loading speeds in all available sizes. The balls can be added quickly and easily in the plant to fit the application.

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REVOLVING TEMPLATE HOLDER FOR TRACER LATHE

Cazeneuve Lathes, Inc., 549 E. Linden Ave., Linden, N. J., producers of high precision tracer lathes has announced the availability of a revolving template holder with its lathe HB 500, HB 575 and HB 725. This permits the turning of shapes such as polygons, ovals, and oblongs, making it ideally suitable for mold, experimental and production work. The work-



New Concept in Gaging and Control!

Now! High magnification, close tolerance, visual gaging with utmost accuracy and reliability, plus ease and simplicity of operation.

Versachek offers these unique features:
• Tolerances within millionths, read at a glance.
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• Common zero for all magnifications from 400:1 to 20,000:1, or more.
• Modular design for easy interchange of units without special skills.
• Power output for operating digital recorders, printers and auxiliary equipment.

Versachek is versatile, too. Using off-the-shelf components you can use Capsules to build custom fixtures and in-process gaging systems, and add modular units — multiple switchers, classifiers, digital voltmeters — to make control, sorting and feedback systems.

Find out about the many ways Versachek can Pay Off for you! Send for Versachek Catalog No. 614.

TAFT-PEIRCE GAGING

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piece and the master revolve in equal revolutions by direct gearing to the spindle. This gear is easily disengaged by the mere push of a slide so that the copy unit can be used on a stationary type. The revolving unit can be mounted on any of the three model lathes.

For more data circle 111 on Postpaid Card

ALLOY STEEL LOCKNUT

A one-piece all-metal "commercial" locknut of the prevailing torque type has been produced by Allen Manufacturing Company, Hartford 1, Conn. Sizes currently offered range from No. 10 through ½ inch, UNC and UNF threads, Designated "Lokon," the locknut is made from heat treated alloy steel, a feature which, according to the manufacturer, gives high strength

without bulk and imparts a degree of elasticity which permits repeated re-use with no significant impairment of the locking action.

Locking is effected by a slight deformation of the top threads into elliptical shape. As the nut is assembled, the out - of - round threads tend to conform to the circular pattern of the mating threads. Friction on the flanks of the nut threads is thus increased to create a positive. powerful locking grip. The company claims that







Alloy Steel Locknut

other advantages include Class 3B threads, temperature resistance to 550 degrees F., conformance with military specifications, tensile strength in excess of 250,000 p.s.i., and a built-in flange which saves washer cost, speeds assembly and reduces indentation. For more data circle 112 on Postpaid Card

modern machine shop *

DUST-FREE CABINET FOR WORK BENCHES

Specialties, Inc., Skunks Misery Rd., Syosset, L. I., N. Y., has introduced the Model B Specialaire Cabinet which is an inexpensive dust-free illuminated work chamber for standard work benches for use in cleaned and non-cleaned areas. The unit is designed to provide high dust arrestance for assembly research and test of gyros, ball bearings, semiconductors, optical and precision instruments, according to the company.

The cabinet operates under a continuous flow of double-filtered air which prevents dust from entering the work area. Cleaned air passing out of cabinet acts as a shield against lint, pollen, dust or dust-borne bacteria. The model features a "packaged filter unit" which protects clean room at-



Specialties Model B Specialaire Cabinet

December, 1961

mosphere when servicing filters. A front hinged panel permits insertion of large work into the 36 by 28 by 18 inch cabinet, Multi-cabinet installations with side opening reduce the need for costly construction of clean rooms. The Specialaire, which has an internal electrical outlet and two speed blower, can also accommodate the use of a microscope through a port in viewing panel.

For more data circle 113 on Postpaid Card



For true radial drill productivity... get a Genuine Radial by Veet.

- V Finger-Tip Clutching ✔ Push Button Elevation
 - V Hardened Column & Way Inserts
 - Automatic Drill Ejector
 Push Button Elevation
 Centralized Controls

 V Head Glides on Ball Bearing Rollers Instant Reverse Tapping V Rigidity of Short Column

Work Height Base . High & Low Base: Double End . Turret Radial

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MODERN MACHINE SHOP

DRILL PRESS

The development of a 15 inch drill press has been announced by Powermatic Machine Co., P. O. Box 70, McMinnville, Tenn. An exclusive feature in the Model 1150 is the complete speed range and full six inch quill stroke now incorporated into a single

unit. The variable speed model provides speeds of 475 to 4800 r.p.m. while the new five speed model provides speeds of 400, 840, 1580, 2800, and 5300 r.p.m., and features cast aluminum alloy pulleys with a large springloaded guard for easier belt changing.

Both versions of the Model 1150 drill press, according to the company, have been designed to minimize deflection and increase accuracy for high precision work. The units feature

heavier spindle bearings, a longer quill and a heavier 3 inch column to assure reduced deflection. The machines are standard equipped with a larger tilting table and a ten-spline spindle.

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TORIT DUST COLLECTORS

now by test ... proof of

HIGH FILTERING EFFICIENCY

Under the most demanding of all filter tests, Torit Cloth Filter Dust Collectors have performed superbly. The testing device—a homogeneous aerosol generator capable of producing uniform sub-micron particles as fine as .05 microns (1/500,000 inch) and as coarse as 15.0 microns—was recently developed by Dr. K. T. Whitby, leading authority on particle technology.

For the first time, tests using such uniform particles indicate fractional efficiency based on particle count... the most exacting filter efficiency test ever devised. How did the Torit Dust Collector measure up in this test? Fractional efficiency when loaded with fine dust ranged from 96% at 0.1 micron to 99.99% at 2.5 microns; and after shaking 10 times, from 88% at

0.1 microns to 99.93 % at 2.5 microns. Such dust collecting efficiency may be just the solution to your dust problems. Torit Dust Collectors install everywhere and they belong everywhere dust is a problem.

WRITE FOR COMPLETE REPORT

Dr. K. T. Whitby's Technical Report on the "Fractional Efficiency Characteristics of a Torit Unit Type Cloth Collector" is now available. Write



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Powermatic Model 1150 15 Inch Drill Press

REE BOO



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POLISH PLASTIC MOLDS — LAP CARBIDE, DIES & TOOLS With Low Cost Tetrabor

Tetrabor is an oil paste of boron carbide especially compounded for lapping carbide tools and dies.

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• INCREASE PRODUCTION — Faster acting Tetrabor permits its use in

place of conventional compounds. Gives superior finish. · Available in 100 gram tube in a

order trial kit containing 5 grams of 12 grits for \$15.50. Or send for free literature and price list. Dealer

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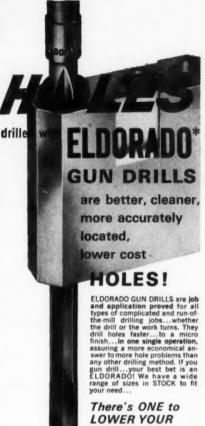
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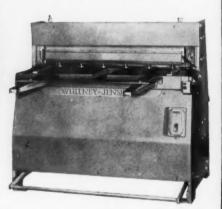
ing same to an existing structure. The normal space of the twisting section is approximately 4 inches, but this may be readily varied at will.

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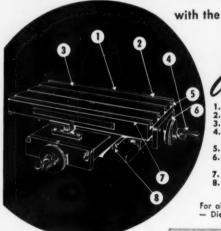
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N.M.T.B.A. Elects Officers

Francis J. Trecker, president, Kearney & Trecker Corporation, Milwaukee, Wisconsin, was elected president of the National Machine Tool Builders' Association at its 60th Annual Meeting, held November 15-17 at the Americana Hotel, Miami Beach, Florida. Ludlow King was re-elected executive vice president of the association.

Wallace E. Carroll, chairman, American Gage and Machine Company, Chicago, Illinois, was elected first vice president and Walter K. Bailey, president, The Warner & Swasey Company, Cleveland, Ohio, was elected second vice president. Lawrence C. Gleason, president and general manager, The Gleason Works, Rochester, New York, was re-elected treasurer. Ralph R. Baldenhofer, vice president and general manager, The Thompson Grinder Company, Springfield, Ohio, was elected secretary of the association.

New directors elected were: Walter K. Bailey, Ralph R. Baldenhofer and Francis L. Dabney, executive vice president, The Bullard Company, Bridgeport, Connecticut.



Walter K. Bailey



Lawrence C. Gleason



Ralph R. Baldenhofer



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WHERE TO GET IT



-A-

Abrasives, Grain, Cloth, Paper, Disc, etc., 12, 13, 66, 67, 68, 141, 263 Actuators, 14, 213 Alloys, 63, 186, 203, 231

Balancers, 15, 267 Balls, Metal, 132 Bars, Fly, 198 Bases, Magnetic, 64 Bearings, Ball, 204, 205 Bearings, Roller, 132, 204, 205 Bearings, Thrust, 204, 205 Benches, Work, 185 Bending Devices, 248 Bending Machines, 37 Bits, Boring, 180 Bits, Tool, 34, 64, 183 Bobs, Felt, 225 Bolts, 128, 129 Boosters, 240 Boring and Turning Machines, Vertical, 54 Boring, Drilling and Milling Machines, Horizontal, 54, 247 Boring, Drilling and Tapping Machines, Multiple, 208 Boring Heads, Inside Front Cover, 29, 198 Boring Machines, 201 Boring Mills, Horizontal, 54 Boring Mills, Vertical, 54 Brakes, Press and Bending, 16, 17, 28, 37, 51, 158, 182 Brazing Powders, 238 Broaches, 64 Broaching Kits, 64 Buffing Machines, 171 Burs, 115 Bushings, Drill Jig. 14, 196, 265

-C-

Cabinets, Dust Control, 245

Cabinets, Test, 177 Calipers, 159, 189 Carbides, 63, 65, 199 Centers, Bench, 267 Centers, Index, 190 Centers, Lathe, Planer, Miller, etc., 5, 55, 162, 172, 213, 229 Chains, 222 Choppers, Scrap, 215 Chucking Machines, 226 Chucks, Automatic, 209 Chucks, Boring, 77, 255 Chucks, Collet, 77 Chucks, Drill, 221 Chucks, Grinder, 151, 255 Chucks, Lathe, 201, 221, 255 Chucks, Magnetic, 46, 201 Chucks, Power, 213 Chucks, Special, Inside Back Cover Chucks, Tap, 182 Chucks, Universal, 255 Chucks, Work-Holding, 255, Inside Back Cover Clamp Components, 200 Clamps, 5, 128, 129, 191, 218 Clinching Machines, 33 Coil Handling Equipment, 215 Collets, 154

Conveying Equipment, 218 Coolants, 153 Countersinks, 34, 210 Cut Off Machines, 180, 181, 199, 211, 217, 253, 257

Control Systems, 53, 188, 195, 234, 247

Controlling Devices, 79, 161, 179

Controls, Time and Operations, 152

Cutters, Deburring, 210 Cutters, Gear, 9

Comparators, 150

Cutters, Inserted Blade and Tooth, 9 Cutters, Milling, 7, 9, 34, 224, 251

Cutters, Special, 210 Cylinders, Hydraulic and Pneumatic. 33, 62, 248

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MODERN MACHINE SHOP

where to get it . . . (Numbers shown are page numbers in this issue)

-D-

Demagnetizers, 161 Diamond Wheels, 69, 241 Diamonds and Diamond Tools, 63, 241 Dies, Punching or Forming, 37, 71, 117, 132b Dies, Threading, 8, 35 Dividing Heads, 192, 201, 220 Dogs, Lathe, Grinder and Miller, 128, 129 Dressers, Grinding Wheel, 235, 241, Dressing Fixtures, Grinding Wheel, 5, 207, 227 Drill Heads, 42, 43, 168, 179 Drill Jigs, 202 Drilling Attachments, 179, 186 Drilling Machines, Automatic, 195 Drilling Machines, Bench, 20, 21, 42, 43, 45 Drilling Machines, Multiple Spindle, 20, 21, 195 Drilling Machines, Numerically Controlled, 52, 132a, 245 Drilling Machines, Radial, 215, 227, 240, 245 Drilling Machines, Vertical, 45, 52, 246 Drilling Units, 42, 43, 186, 253 Drills, Center, Core, Twist, etc., 9, 34, 213, 218, 233, 247 Drills, Portable Pneumatic, 39 Drills, Square and Hexagon, 229 Drivers, Tap, 242 Drivers, Tool, 242 Dust Control Equipment, 155, 193, 246 -E-

End Mills, 9, 34, 140a,b,c,d

-F-

Facing Heads, 29
Feed Units, 268
Files, 58, 210
Filing Machines, 50
Finishing Machines, 155
Flats, Glass Optical, 163
Flexible Shaft Equipment, 42, 43
Fluids, Cutting, 57
Forming Machines, 22, 36, 37, 73, 158, 208
Furnaces, Heat Treating, 206, 232

-G-

Gage Blocks, 163 Gages, 8, 14, 35, 121, 132a, 150, 163, 166, 189, 197, 200, 224, 243 Gear Cutting Machines, 12, 13 Gears and Gear Units, 231 Generators, 211 Grinders, Abrasive Band and Belt, Grinders, Center Type, 10, 11 Grinders, Centerless, 10, 11, 12, 13 Grinders, Chucking, 10, 11 Grinders, Cutter and Tool, 29, 32, 221 Grinders, Cylindrical, 10, 11 Grinders, Drill, 42, 43, 238 Grinders, Face, 19 Grinders, Hand, 42, 43 Grinders, Hydraulic, 19 Grinders, Lathe, 171 Grinders, Portable Pneumatic, 197 Grinders, Roll, 10, 11 Grinders, Surface, 19, 38, 117, 174 Grinders, Tool Post, 42, 43, 171 Grinders, Universal, 40 Grinders, Vertical Spindle, 40, 171 Grinding Fixtures and Attachments, 188, 22 Grinding Heads, Inside Front Cover Grinding Wheels, 12, 66, 67, 68, 116, 125, 191

-H-

Handles, Machine, 200, 227 Handwheels, 190, 200, 227 Hardness Testing Devices, 173 Hinges, 225 Hobbing Machines, 221 Hobs, 6, 9 Holders, Blueprint, 211 Holders, Punch, 71 Holders, Tap, 242 Holders, Template, 243 Holders, Tool, 77, 81, 128, 129, 169, 208, 211, 223, 242 Holders, Type, 165

-1-

Indexing Heads, 201 Indexing Units, 168, 213, 217 Indicators, 211, 233 Induction Heating Equipment, 176 Instruments, Surface Measuring, 127

256 MODERN MACHINE SHOP

December, 1961

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December, 1961

MODERN MACHINE SHOP

where to get it . . . (Numbers shown are page numbers in this issue)

-1-

Jaws, Chuck, 192, 218
Jig and Fixture Components, 14, 184, 191, 207
Jig Borers, 48, 49
Jig Borers, Numerically Controlled, 48, 49

-K-

Keys, Machine, 209 Knobs, Hand, 200, 227 Knobs, Machine, 200, 227

Jig Mills, 29

-L-

Lapping Compounds, 247 Lapping Machines, 12, 13 Lathes, Automatic, 15 Lathes, Bench, Front Cover Lathes, Engine and Toolroom, Front Cover, 4, 174, 178 Lathes, Speed, 59, 146 Lathes, Tracer, 4 Lathes, Turret, 15, 47 Lathes, Vertical Turret, 54 Layout Materials, 234 Levels, 187 Levers, 227 Light Wave Measuring Equipment, Lighting Equipment, 233 Liners, 147 Locknuts, 244

-M-

Magnets, 131 Magnifiers, 187 Mandrels, Ball, 242 Marking Devices, 117, 170, 223 Measuring Instruments, 26, 214 Metallizing Equipment, 30, 31 Micrometers, 26, 228 Microscopes, 113, 183 Milling Equipment, Portable, 42, 43 Milling Fixtures, 213, 217 Milling Machine Attachments, 27 Milling Machines, Horizontal, 28 Milling Machines, Turret, 27 Milling Machines, Universal, 192 Milling Machines, Vertical, 28, 44, 192 Mills, Carbide, 210 Mills, Midget, 210

Motors, 41, 189, 236 Mounted Wheels and Points, 266

-N-

Nibblers, 202 Notching Units, 71 Nuts, Tee, 128, 129

-0-

Oilers, 201

-P.

Parts, Machine Tool, Production, Aircraft, etc., 14 Pins, Dowel, Taper, etc., 232, 265 Pins, Headed, 232 Pins, Locating, 265 Plates, Angle, 206, 225 Plates, Screw, 8 Plates, Surface, 14, 198 Polishing Machines, 171 Presses, Arbor, 25 Presses, Drawing, 37 Presses, Hydraulic, 25, 41, 219 Presses, Power, 25, 36, 56, 158, 167, Presses, Punch, 230 Presses, Stamping, 16, 17 Projectors, Profile, 14 Pullers, 215 Pumps, Coolant and Lubricant, 239,

Pumps, Hydraulic, 41 Punches, 71, 229 Punching Units, 71 Pushers, 154 Pyrometers, 234

-Q-

Quills, 42, 43

-R-

Ratiomotors, 23 Reamers, 9, 34, 210 Rectifiers, 161 Reductors, 23 Reels, 215 Refractories, 12, 13, 66, 67, 68 Riveting Machines, 33, 145, 188, 196, 210 Rolling Machines, 22, 50, 199



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-S-

Sanding Machines, Belt and Disc, 212 Saw Blades, Band, 18, 58, 183 Saw Blades, Hack, 58, 183 Saw Blades, Hole, 58, 183, 216 Saw Blades, Power, 58 Saw Frames, Hack, 58, 183 Sawing Machines, Band, 18, 190, 222, 231, 253 Sawing Machines, Circular, 253 Sawing Machines, Hack, 238, 253 Saws, Portable Electric, 190 Screw Machine Specialties, 212 Screw Machines, Automatic, 108, 109, 123 Screws, Cap, Set, Socket and Machine, 212, 248, Back Cover Screws, Transfer, 200, 235 Sealants, 148 Segments, Grinding, 116 Services: Milling, Grinding, Lapping, Rebuilding, Repairing, Business, etc., 163, 202, 208, 217, 229, 231, 234, 249 Shapers, 12, 13, 28, 51, 176 Shearing Machines, 16, 17, 28, 51, 208, 250 Slide Assemblies, 268 Special Machinery, 37, 190 Spindles: Grinding, Boring, Milling, etc., 14, 24, 162, 168, 208, 268 Spinning Machines, 73 Stampings, Pressed Metal, 149 Steel, Tool, 107 Steel Stock, Ground Flat, 183 Stops, Collet, 233 Stops, Drill, 242 Superfinishing Machines, 15 Surface Measuring, 127 Swaging Machines, 214

-T-

Tables, Elevating, 209
Tables, Machine, 268
Tables, Milling and Grinding, 172, 251
Tables, Rotary and Index, 190, 206, 209, 217, 219, 225
Tap Extractors, 236
Tapes, Pressure Sensitive, 12, 13, 66, 67, 68
Tappers, Automatic, 179
Tapping Attachments, 168, 179, 207

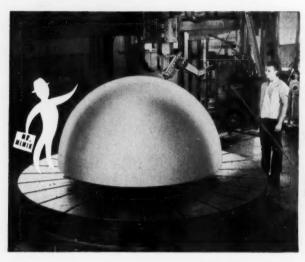
Tapping Heads, 168, 179, 207 Tapping Machines, 168, 216 Tapping Units, 42, 43, 168, 207 Taps, 8, 35, 193, 251 Templates, 200 Threading Machines, 199 Tips, Tool, 29 Tool Blanks, 213 Tool Posts, 169 Tool Presetting Devices, 237 Tools, Balancing, 267 Tools, Boring, 29, 185, 198, 235 Tools, Burnishing, 259 Tools, Carbide, 9, 115, 227 Tools, Ceramic Tipped, 29 Tools, Cleaning, 211 Tools, Cutting Off, 227 Tools, Deburring, 251 Tools, Dressing, 235 Tools, Engraving, 117 Tools, Facing, 185 Tools, Fastening, 60 Tools, Grooving, 185 Tools, Lapping, 217 Tools, Nutrunning, 60 Tools, Recessing, 194 Tools, Relieving, 219 Tools, Screwdriving, 60 Tools, Setup, 128, 129 Tools, Threading, 101 Tools, Trepanning, 212 Tracers, Lathe, 249, 261 Tubes, Collet and Pusher, 154 Turrets, Lathe, Tool Post, Bed and Tailstock, 160

-V-

Valves, 194, 228 Vises, Bench and Machine, 201, 209, 225, 253

-W-

Washers, 128, 129
Ways, Machine, 61
Wear Parts, 61
Wedges, 128, 129
Welding Equipment and Supplies,
50, 186, 226, 230
Wire Straighteners, 215
Wires, Measuring, 163
Wrenches, 128, 129
Wrenches, Torque, 235



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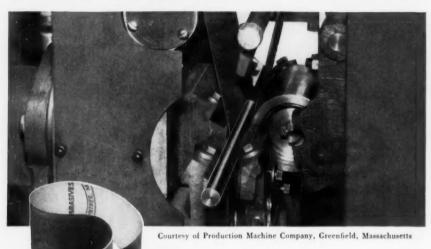


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Adam Tool Co	Bullard Co
Aget Mfg. Co	Bystrom Co
Allegheny Ludium Steel Corp65, 107	
Allison-Campbell Div.,	Cam Services Co.,
American Chain & Cable Co., Inc 257	Div. of Himoff Machine Co 24
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American Bechler Corp	Carmet Div., Allegheny Ludlum Steel Corp 6:
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American Sealants Co	Cincinnati Lathe & Tool Co
Anton Machine Wks	Cincinnati Milling Machine Co 10, 11, 73
Apex Machine & Tool Co 60	Cincinnati Milling Machine Co.,
Armstrong-Blum Mfg. Co	Cincinnati Milling Products Div 125
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Atrax Co	Clausing Div., Atlas Press Co 44
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Merryweather Mchry, Co 195, 253	Cleveland Twist Drill Co
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Bardons & Oliver, Inc	Cook Lead Hammer Service231
Bath Co., Cyril37	
Bausch & Lomb, Inc	Dake Corp
Bay State Tap & Die Co	Defiance Machine & Tool Co 170
Bearings, Inc	Delta Power Tool Div., Rockwell Mfg. Co. 20, 21
Bellows-Valvair Corp	Denison Engr. Div41
Black Drill Co	Desmond-Stephan Mfg. Co 235
Blanchard Machine Co	DeVlieg Microbore,
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-/	Lyon Metal Products, Inc
Edroy Products Co	7
Edroy Products Co	M & M Tool & Mfg. Co
Eisler Engr. Co., Inc	Machine Products Corp
Eldorado Tool Co	Madison Industries Inc
Electro-Matic Products Co	Martin Machine Co., J. E
Enco Manufacturing Co	Mathewson Machine Wks., Inc 202
Ettco Tool & Machine Co 168	McDonough Mfg. Co
Ex-Cell-O Corp	
	Mead Specialties Co
Field & Son, Inc., Walter W	Metallurgical Products Dept.,
Fosdick Machine Tool Co	General Electric Co
Fowler, Fred	Metco, Inc
temor, tree transfer to the temperature to the temp	Methods Research Corp
0	Miller Fluid Power Div., Flick-Reedy Corp. 240
Gatco Rotary Bushing Co	Mimik Tracers, Inc
Gisholt Machine Co	Modern Collet & Machine Co 154
Grant Mfg. & Machine Co	Monroe Engineering Products, Inc 200
Graphic Systems188	Morris Co., Robt. E
Graymills Corp	Morton Machine Wks,
Greenerd Arbor Press Co	
Grob, Inc50	National Acme Co 101, 108, 109
Gwilliam Co	Nebel Machine Tool Corp
	Neise, Karl A
Hammond Mchry, Builders, Inc 164	New Hermes Engraving Machine Corp32
Hardinge Brothers, Inc First Cover	Niggara Machine & Tool Wks,
Hayden Twist Drill Sales Co	Nichols-Morris Corp
Heald Machine Co Second Cover	Nielsen, Inc
Heimann Mfg. Co	Nielsen Tool & Die Co
Heinrich Tools, Inc	Nilson Machine Co., A. H
Hannes & D.M. Mr. Co. 222	Nirol Mfg. Co
Hoggson & Pettis Mfg. Co223	Nobur Mfg. Co
Holo-Krome Screw Corp Fourth Cover	
Houghton & Co., E. F	Norton Co
Huron Machine Products, Inc 218	Numberall Stamp & Tool Co
	Nu-Tangs, Inc
Ideal Industries, Inc	01: K : C
Illinois Tool Wks	Ohio Knife Co
Insta-Clamp Co	Olson Industrial Products, Inc 249
	Ottemiller Co., W. H
J & S Tool Co., Inc	D 1/1 D 8 Ch C- 100
Johansson Co., I. O	Pacific Press & Shear Co
Johnson Machine & Press Corp 203	Palmgren Products225
	Pangborn Corp
Johnson Mfg. Corp222	Peerless Machine Co
	Pemco Perforators Co
Karlan Tool & Mfg. Co	Penniman, Elisha213
Kelm Mfg. Co	Permag Corp
	Pipe Mchry. Co
L-W Chuck Co	Porter Machine Co
Laminated Shim Co., Inc	Power Grip, Inc
Landis Tool Co	Pratt & Whitney Co
Lawley Granite Surface Plate Co 202	Precision Diamond Tool Co 69
Leland-Gifford	Precision Welder & Flexopress Corp56
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Schupack Supply Co.	Thermolyne Corp
Seibert & Sons, Inc	Thomas Hoist Co
Service Machine Co., Inc	Thriftmaster Products Corp
Severance Tool Industries, Inc	Titan Tool Supply Co., Inc247
Sheffield Corp	Tomkins-Johnson Co
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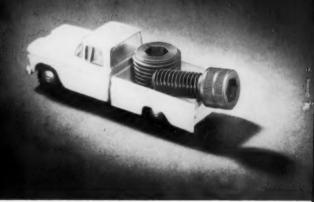
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